Botanical Resources at Emma Wood State Beach and the Ventura River Estuary, California

Inventory & Management

State of California – The Resources Agency
Department of Parks and Recreation

The Herbarium, Department of Biological Sciences, University of California, Santa Barbara

Cover

Right: Aerial view of Emma Wood State Beach Group Campground and adjacent Seaside Wilderness Park; City of San Buenaventura at lower right.

Top Left: Beach Primrose *(Camissonia cheiranthifolia ssp. suffruticosa)*, a native dune species.

Center Left: View southeastward across Southern Coastal Dune vegetation to the Pacific Ocean.

Bottom Left: View northward of the upper Ventura River Estuary.

Botanical Resources at Emma Wood State Beach and the Ventura River Estuary, California: Inventory and Management

Report to
The State of California
Department of Parks and Recreation

by

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FOREWORD

This report, "Botanical Resources at Emma Wood State Beach and the Ventura River Estuary, California: Inventory and Management", is contribution No. 15 by the Environmental Research Team to the UCSB Herbarium Environmental Report Series. Principal funding for the inventory and analysis has been provided by the State of California Department of Parks and Recreation, Patagonia, Inc., Friends of the Ventura River, and the UCSB Herbarium. Management issues were focused as per a contract with the Department of Parks and Recreation.

The Environmental Research Team is composed variously of UCSB faculty, staff, and students who conduct botanical resource studies that are supported by contracts or grants from local, State, or Federal agencies or from foundations or other private groups. Funds obtained through these projects are used to support students and activities of the UCSB Herbarium. The contract and grant program of the Herbarium is one vehicle used to provide services to the public and the scientific community and to enhance our knowledge of botanical resources in California.

The project reported herein is part of an ongoing study of the physical and biological resources of the Ventura River Watershed that has been organized by the Friends of the Ventura River. Our report covers (1) Emma Wood State Beach-Ventura River Group Camp, which is owned and managed by the Department of Parks and Recreation, (2) Seaside Wilderness Park, which is owned by the City of San Buenaventura, and (3) adjacent publically and privately-owned parcels. Recommendations presented in the report are aimed towards an integrated management plan that could be implemented for all parcels in the vicinity of the complex ecosystem of the Ventura River Mouth.

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INTRODUCTION

Background

The Ventura River Estuary and related habitats occur in southern California (Fig. 1) immediately west of the urbanized portions of the City of San Buenaventura, and about 60 miles (100 km) west of Los Angeles (Fig. 2). In 1988, the Environmental Research Team of the UCSB Herbarium was awarded a contract to examine the botanical resources at Emma Wood State Beach-Ventura River Group Camp. Prior to the award of this contract, the Team had begun a study of the botanical resources of the Ventura River Delta area and related parcels in January 1987 at the request of the Friends of the Ventura River and with initial funding granted by Patagonia, Inc. This report includes information gathered as a result of both investigations.

The Ventura River Estuary and related riparian and marine wetlands and coastal dune habitats (Figs. 3, 4) have long attracted human attention and use. The earliest historical records of the area date to 1542 when Juan Rodriguez Cabrillo anchored off the coast of the region and noted a large colony of Native Americans (Chumash Indians) settled near the mouth of what is now known as the Ventura River. In 1782, Father Junipero Serra established the ninth California mission near the eastern banks of the river mouth and called it San Buenaventura. Following the overthrow of Spanish rule in 1822 and the formation of the Republic of Mexico, the lands were secularized in 1833 and converted to ranches. Today, these mission lands are included within the County of Ventura and partially within the City of San Buenaventura (Fig. 2), which is a coastal city occupied by approximately 86,000 people.

Prior to the UCSB study, most of the attention on natural resources had been focused on the Steelhead trout fishery (e.g., Ventura County Fish and Game Commission 1973; California Department of Parks and Recreation 1975; Moore 1980). Although this fishery has been impacted by dams, diversions, and waste discharges, the Ventura River is one of the few in southern California where the marine and estuarine habitats are still contiguous to extensive riverine habitats. These contiguous wetland habitats account for the diversity of botanical

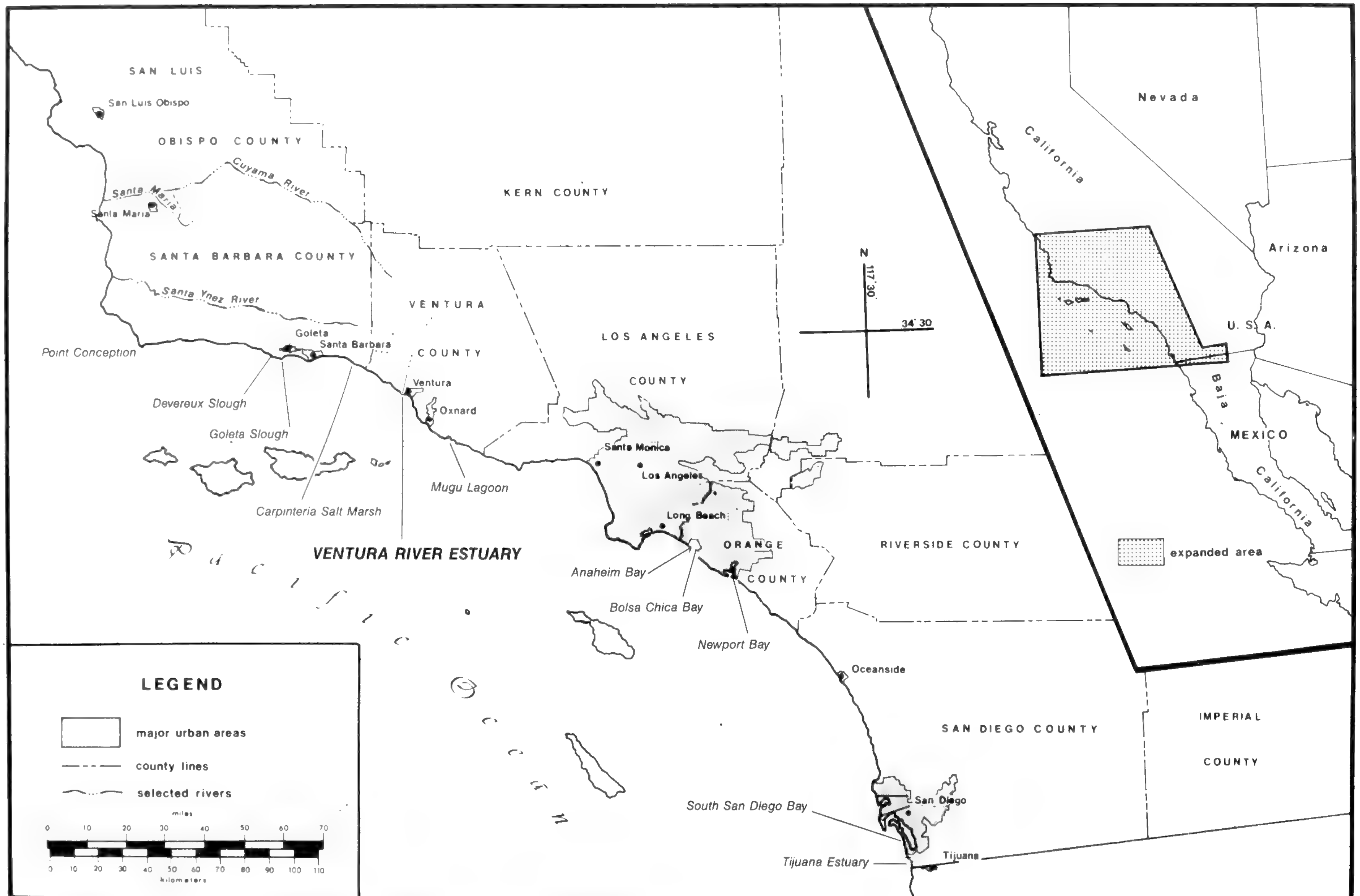

FIG. 1. LOCATION OF THE VENTURA RIVER ESTUARY (and the Study Area, including Emma Wood State Beach–Ventura River Group Camp, and Seaside Wilderness Park)

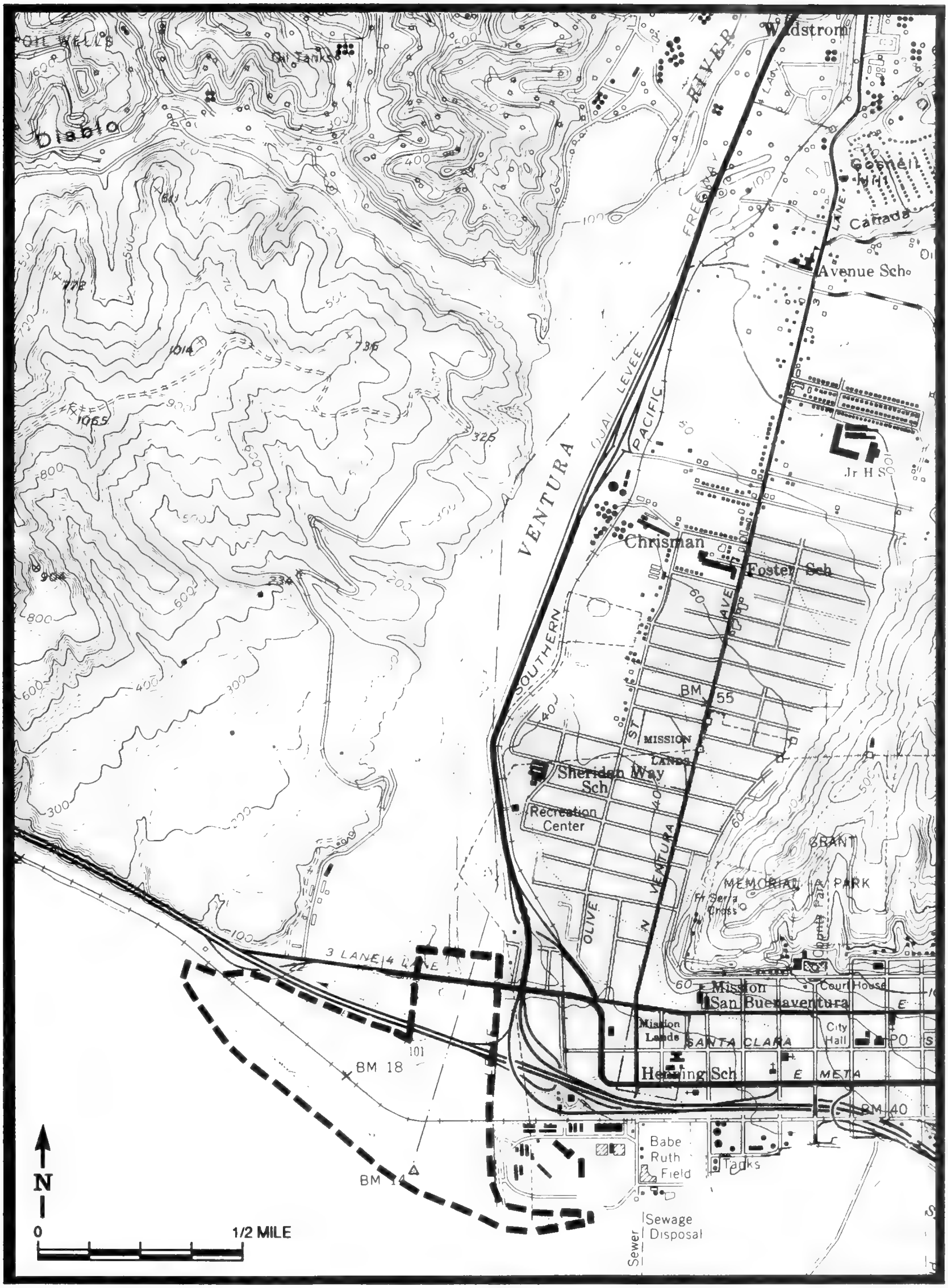

FIG. 2. TOPOGRAPHIC MAP OF THE LOWER VENTURA RIVER BASIN. (Modified from the Ventura 7.5 minute Quadrangle 1951, photo revised 1967). The general study area is outlined by a bold, dashed line.

resources, including some narrowly restricted estuarine plants found at the Ventura River Mouth.

Several previous investigations have documented aspects of the botanical resources of the study region. Henry M. Pollard (1886-1973), a teacher in local private schools, collected the flora of the Ventura River watershed for approximately 30 years beginning in 1944, but never published his intended flora (Smith 1976). Some of Pollard's information was included by C. Smith in his *Flora of the Santa Barbara Region* (Smith 1976), an important annotated catalogue covering coastal wetlands including the Ventura River. His card files and herbarium specimens contributed to the historical aspects and completeness of our work.

Other works include generalized vegetation maps and species lists produced for CALTRANS (North American School of Conservation and Ecology 1972), the Emma Wood State Beach Management Plan (California Department of Parks and Recreation 1975), the Ventura County Fish and Game Commission (Capelli 1973), and a UCSB student research project (Boyle 1976). These efforts are useful for their historical account of the resources, but they lack sufficient detail and completeness to document the richness of the vegetation, flora, and habitats.

Although the Ventura River Estuary and related habitats at Emma Wood State Beach have received numerous and significant impacts (such as fragmentation by transportation corridors, reduction of stream flows by dams and diversions, reduced water quality from waste discharges and urban runoff, loss of coastal habitats due to increased erosion of the coastal dunes, and perturbations from human access to sensitive areas), the combined biological resources of the study sites are believed to be of sufficient regional or statewide significance to warrant detailed study, and careful restoration and management (California Department of Parks and Recreation 1975). These goals for inventory, analysis, and action will help achieve the long-term protection and restoration of the area for the appreciation of future generations of visitors and for continued research and education.

FIG. 3. THE GENERAL STUDY AREA, 1987. Aerial view northward up the Ventura River illustrating Seaside Wilderness Park (south of the Southern Pacific Railroad including the lower Ventura River Estuary), Emma Wood State Beach Ventura River Group Camp (south of U.S. Highway 101 and west of the Park), and the Hubbard Property (south of Main Street Bridge). The City of San Buenaventura occurs east of the Ventura River.

FIG 4. THE VENTURA RIVER ESTUARY, 1989. View northwestward from the U.S. Army Corp of Engineers' levee, across the mouth of the estuary at low tide, toward "Hobo Jungle" at Seaside Wilderness Park, and a bridge for the Southern Pacific Railroad. Coastal foothills (Taylor Ranch) of the Transverse Range occur in the background.

Study Sites

The general study area (Figs. 3, 5) covers approximately 110 acres (45 hectares) and includes three distinct study sites (Emma Wood State Beach-Ventura River Group Camp, Seaside Wilderness Park, and the Hubbard Property), each with separate regulatory authorities, plans, and sensitive resource issues. Because of their physical and biological interrelatedness, they are best analyzed when studied as one area. Because of different ownership and management concerns, however, we describe them individually.

Emma Wood State Beach. Emma Wood State Beach is a narrow strip of coast covering 115 acres (47 hectares) and extending 2.7 miles (4.4 km) west from the mouth of the Ventura River to the community of Solimar. It includes a western portion acquired in 1957 for family camping along the immediate coast, and an eastern portion called Ventura River Group Camp (Fig. 5). The latter area covers 67 acres (27 hectares) and was acquired in 1971 and 1972 for a group campground and to develop a program interpreting the natural resources in the vicinity of the mouth of the Ventura River (California Department of Parks and Recreation 1975). In addition to the group camping facility, the site includes: 1) a portion of the upper Ventura River Estuary; 2) the "second mouth" of the river; 3) riparian scrub and woodland; 4) coastal dune and strand habitats; and 5) marine intertidal wetlands (Fig. 3). This portion of the State Beach is fragmented into subareas by the Southern Pacific Railroad [covering an additional 10 acres (4 hectares)], and various unpaved access roads. Seven undeveloped oil drill rights were retained within the Emma Wood State Beach by the Adrian Wood Estate, previous owners of the property, for future oil extraction purposes (City of San Buenaventura 1982). A General Development and Resource Management Plan was adopted for the area by the State Parks Commission in 1976.

Seaside Wilderness Park. This 20 acre (8 hectares) parcel (Fig. 5) was part of a large site acquired privately to create a park (Jacobson 1984). After initial landscaping efforts, the land was given in 1909 to Ventura County, which in turn gave the park to the City of San Buenaventura in 1969. Today (Figs. 3, 4) it is an undeveloped site that includes the lower Ventura River Estuary, a coastal strand,

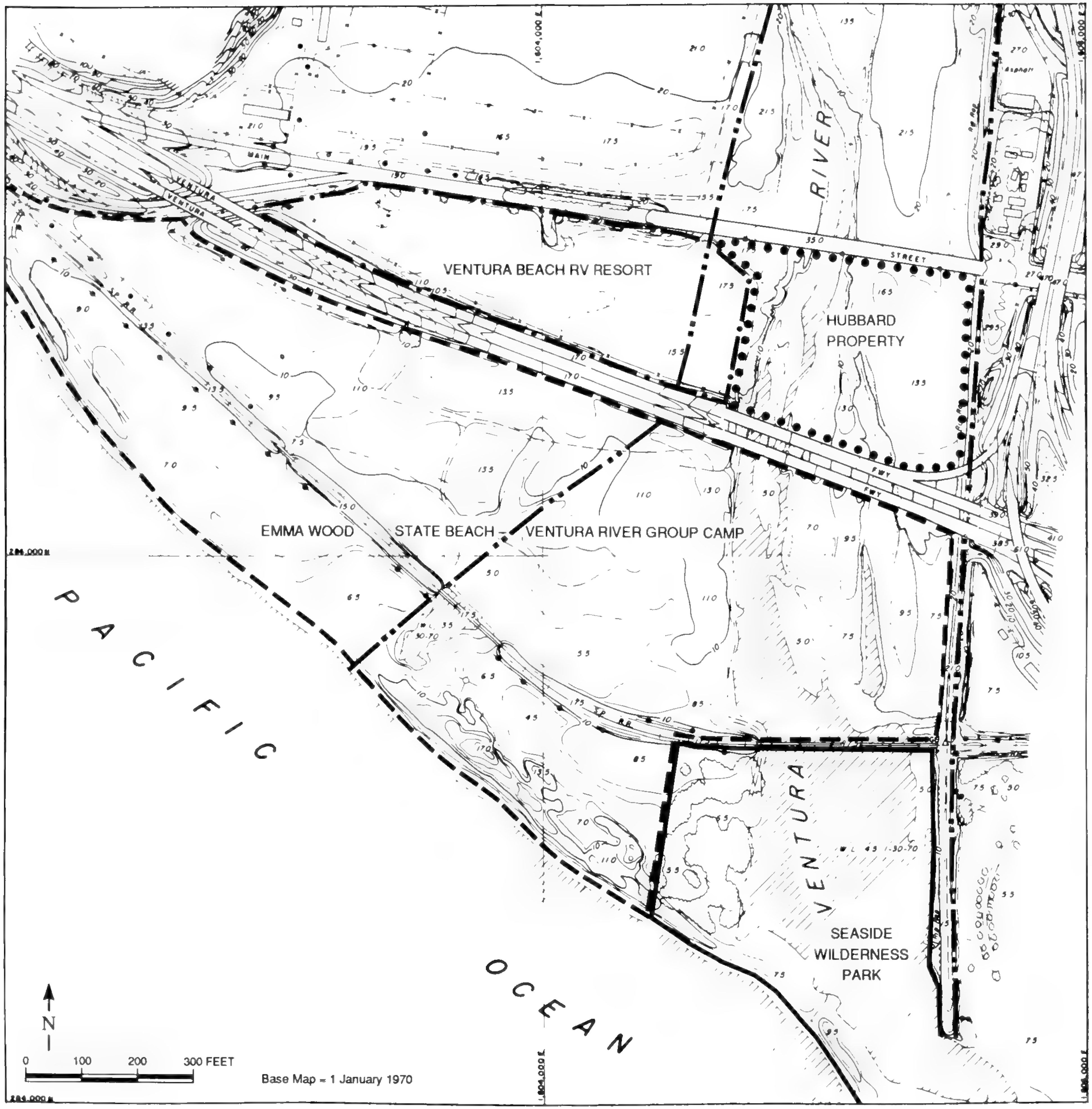

Fig. 5. Topographic, Ownership, and Regulatory Boundary Map

Emma Wood State Beach - Ventura River Group Camp
(State of California, Department of Parks and Recreation)

Seaside Wilderness Park
(City of San Buenaventura-ownership)

Hubbard Property
(Private)

Permanent Easement for Channel Clearing and Maintenance
(Ventura County Flood Control District)

Ventura Beach RV Resort
(Private)

The entire study area occurs within the City of San Buenaventura.

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marine wetlands, and a disturbed area also known locally as "Hobo Jungle", which is characterized by planted trees, Salt Bush Scrub, and various herbaceous plants .

Hubbard Property. This site covers approximately 9 acres (3.6 hectares) between U.S. Highway 101 and the Main Street Bridge (Fig. 5), and is part of a larger parcel that includes the Ventura Beach RV Resort, which occurs west of the river levee and urbanized portions of the City of San Buenaventura. The Hubbard Property includes the transition between habitats of the upper estuary and lower river, and various types of riparian scrub and woodland. In addition, this study site includes a 4 acre area immediately above the Main Street Bridge, which is under separate ownership.

Purpose

As funded by the State of California Department of Parks and Recreation, the general purposes of the UCSB contract were to : 1) conduct an inventory of the botanical resources at Emma Wood State Beach; 2) identify, describe, and provide a plan for the unique management areas; 3) describe alternatives for an invasive exotic plant removal program; and 4) identify interpretive themes and locate potential access and interpretive sites within the State Beach. Because the larger study, of which this report is a part, also has been funded by other groups (e.g., Patagonia, Inc., UCSB Herbarium, and Friends of the Ventura River) and has covered other issues and additional sites (e.g., Seaside Wilderness Park and the Hubbard Property), the purpose of this report includes the results of the progress to date regarding the larger integrated study. Thus, the refined purposes of the investigation reported herein are:

1. To provide a description of the physical environment (including geologic history, watershed characteristics, and flooding and salinity regimes of the estuary and lower river) as they relate to the nature, sensitivity, and management of botanical resources and habitats.

2. To describe the land use and disturbance history of the study sites and the influence of particular events on the formation of plant habitats and the stability of botanical communities.

3. To conduct an inventory of the terrestrial and aquatic botanical resources (including marine algae) at Emma Wood State Beach, Seaside Wilderness Park, and the Hubbard Property, including: a) classification, mapping, and description of the vegetation; b) documentation and analysis of vegetation on permanent transects placed throughout the study area; c) inventory and analyses of the flora, particularly species of special interest; and d) a prioritized list and map of the invasive exotic plants.

4. To identify and evaluate management opportunities including, for example, unique management areas, alternatives for removal of invasive exotic plants, and potential for restoration of habitats.

5. To identify interpretive themes and locate potential access and interpretive sites at Emma Wood State Beach and adjacent areas.

6. To make recommendations regarding the future management, research, and interpretation of botanical resources and other biological resources at the Ventura River Group Camp and adjacent areas.

METHODS

Physical Environment

To summarize aspects of the physical environment, as they relate to the composition and richness of the botanical resources, we compiled existing information and/or conducted new studies on the geologic history, climate, watershed and physiography, drainage and flooding, soils, river flow, salinity and tidal flushing and habitats of the study area. Selected information obtained through this process is summarized in the Physical Environment portion of this report to provide an environmental setting from which conclusions can be drawn regarding the functioning of the river mouth ecosystem and the management of botanical resources.

We obtained information on the geologic history of the Ventura River Watershed from Putnam (1942), Norris and Webb (1976), Lajoie et al. (1979), Lajoie and Sarna-Wojcicki (1982), Dembroff et al. (1982), and Dahlen (1988). Aspects of the regional climate were summarized by J. R. Haller, with estimates of precipitation provided by the U.S. Army Corps of Engineers (1971). A watershed description and drainage and flooding estimates and predictions were derived from U.S. Army Corps of Engineers (1971), Putnam (1942), and U.S. Bureau of Reclamation (1954).

Description of soils and nonsoil substrates was summarized from Edwards et al. (1970). Salinity data (total dissolved solids) were recorded in 1988 and 1989 by the Environmental Research Team at irregular intervals using a temperature-compensated refractometer. Additional data were obtained from the Casitas Municipal Water District (Ternes 1989). Habitats were defined, delineated, and described by application of a modified version (Ferren 1989) of the definition and classification of wetlands by the U.S. Fish and Wildlife Service (Cowardin et al. 1979). Habitat site areas (Fig. 6) were named for ease of reference throughout the report.

Land Use History

Our interpretation of the land use history of the study area is based upon (1) examination of aerial photographs (1938-1989) and maps (1855-1967) obtained from the UCSB Map and Imagery Lab and Friends of the Ventura River, and (2) from field observations, personal communications, and published accounts for Native American occupation (e.g., Greenwood and Browne 1969, Cook 1976), the Spanish period (e.g., Englehardt 1930, Browne 1974), Mexican period (e.g., Englehardt 1930), early statehood period (e.g., Robinson 1955, Cleland 1969), and Modern American period (e.g., U.S. Army Corps of Engineers 1971, Marmor n.d.). Capelli used this information and the extensive files of the Friends of the Ventura River to produce a summary of land use and its effects on the botanical habitats.

Botanical Resources

Vegetation Classification and Mapping. Vegetation of uplands and nonmarine wetlands was observed and described during a series of 12 reconnaissance trips conducted by Ferren et al. between June 1987 and August 1989. A hierarchical classification was prepared, based on a modified system by Cowardin et al. (1979) and Ferren (1989). The vegetation of the marine wetlands and near shore deepwater habitats fronting the study area were observed during a series of 15 reconnaissance trips by Capelli et al. from April 1987 to October 1989 during periods of 0.0 to -1.2 foot tides. A hierarchical classification of vegetation was prepared using Cowardin et al. 1979. Dominant or characteristic species of plants and algae were recorded for each category of vegetation listed in the integrated wetland and upland classification. "Habitat Site Names" (Fig. 6) were applied to various areas to aid in the communication of information about sites with unique habitat, location, and vegetation characteristics.

Using our classification scheme, Ferren et al. mapped upland and nonmarine macrophyte assemblages from aerial photograph PW-VEN-5-117 (10 Dec 1986), which was purchased from Pacific Western Aerial Surveys. Capelli mapped the marine algae and macrophyte assemblages from aerial photograph PW-VEN-5-117 (10 Dec 1986). Magney mapped 10 selected species of exotic invasive vegetation from aerial photograph PW-VEN-5-117 (10 Dec 1986). The

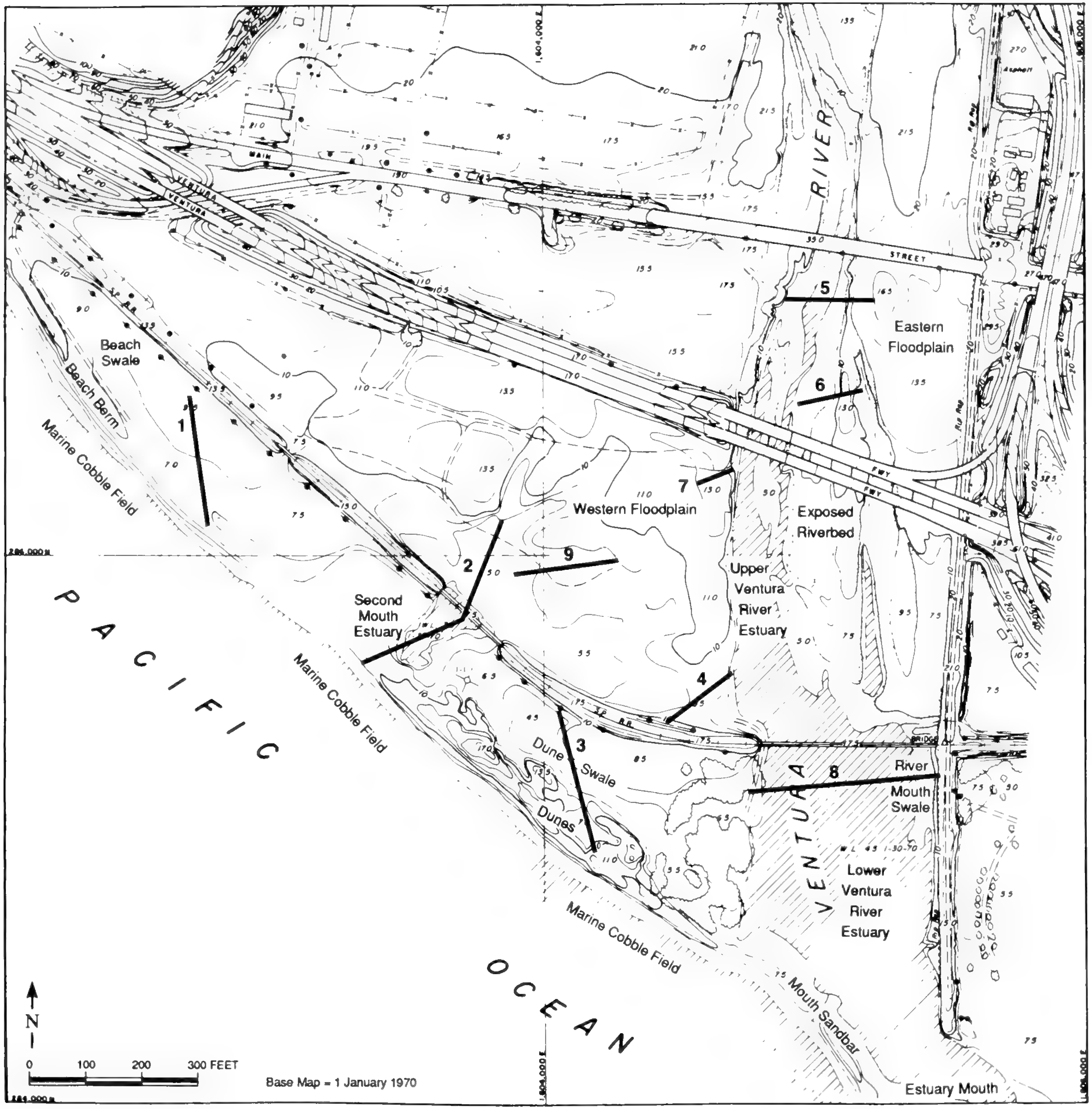

Fig. 6. Location of Transects and Informal Habitat Site Names

Transects

1. Beach Swale and Beach Berm
2. Second Mouth Estuary
3. Dune Swale and Dune
4. Disturbed Floodplain
5. Floodplain and River Channel
6. Exposed Riverbed
7. Riparian Woodland Floodplain
8. Lower Ventura River Estuary
9. Riparian Scrub in Temporary Channel

Habitat Site Names

Western Floodplain
Eastern Floodplain
Upper Ventura River Estuary
Lower Ventura River Estuary
Beach Swale
Dune Swale
Dunes
River Mouth Swale
Exposed Riverbed
Beach Berm
Second Mouth Estuary
Estuary Mouth
Mouth Sandbar
Marine Cobble Field

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maps were field checked for accuracy and compared against our transect data and classification scheme for consistency.

The area covered by each unit of upland or nonmarine wetland or deepwater habitats illustrated on the vegetation map for the study area (Appendix II), was determined by cutting and weighing portions of the map and then comparing the combined weights of the various types of polygons, which represent sites dominated by a particular vegetation or habitat, with the weight of a measured piece (200 ft. X 200 ft.) of the vegetation map. For each unit of vegetation or habitat, percent of the total study area was determined by comparing the total weight of each category against the total weight of all units illustrated on the map. Vegetation or habitat units were ranked from those with the largest area to those with the smallest area.

Quantitative Vegetative Analysis. *Field Methods.* A preliminary examination of the vegetation communities at the Ventura River Delta was carried out on 15 July 1988, during a reconnaissance trip by team members. Based upon project requirements specified by the California Department of Parks and Recreation, we identified the major study sites on an aerial photograph, and located transects (numbered 1 to 8) in the field (Fig. 6). During later field trips, we added another transect to the data (no. 9). The transect end-points were initially fixed by stake markers driven into the ground. During vegetation and topographic surveys at later dates, we located smaller stakes at approximate intervals of 50 meters between these end-points. Field work for surveying vegetation along Transects 1-8 was conducted by A. Parikh and K. Clark in August 1988, and continued through October 1988 for Transect 9. The topographical surveys were done in September 1988.

To survey the species composition along each transect, we used two methods of field cover estimation of species. The line-intercept transect method was used to sample species cover along the transects (Barbour et al. 1980), with total percent cover being the final cover estimate for each species. To further characterize species composition on each transect and for random locations over the entire study area, we chose the relèvè plot method of sampling (Barbour et al. 1980). This method was preferred over quadrat sampling because the height and composition of dominant vegetation canopy layers was extremely variable within and between transects; a relèvè plot of 100 square meters was chosen to sample

vegetation communities for the entire study area. Approximately 3-6 circular releve plots were located along each transect. A complete species list is given in Appendix V.

Physical data collected for each plot included slope and aspect; a "southness index" [=cosine(aspect) sine(slope)] was computed from these data. A high positive value for the index indicates the presence of a steep, south-facing slope. A surveyor's level was used with a stadia rod to determine elevation at intervals of approximately 2.5 meters along each transect. Elevations of each point above mean sea level were calculated from these data, using reference locations of two bench marks in the area (Ventura County Surveyors, and the U.S. Coast and Geodetic Survey). Elevations at the center of each releve plot were also calculated from the surveying data. A descriptive "flooding index" was derived for each plot based on field observation and differentiation of elevation classes.

In addition to species percent cover, vegetation variables recorded for each releve plot included dominant canopy heights. Where higher layers were present (e.g., tree species such as *Salix* spp.), we recorded diameter at breast height (dbh in cm) for individual stems of each species. Dbh values were used to calculate basal area for each tree species.

Graphical Data Analysis. For each transect, elevational/topographical profiles with the corresponding locations of releve plots were constructed. Species distributions along each transect with the corresponding total percent cover were also plotted, so that species occurrences in relation to topographical variation could be compared visually (Appendix V, Figs. V-1-18).

Quantitative Data Analysis. Vegetation data were used to numerically ordinate and classify communities in the area. The curvilinearities of ecological data (Gaussian species distributions along environmental gradients, lack of separability of environmental factors, and nonlinear relationships between similarity values and environmental factors) typically make ordination techniques, such as principal components analysis (PCA), polar ordination, and reciprocal averaging, inappropriate for the analysis of vegetation communities, due to linear data assumptions of PCA, and the correlation of ordination axes in other methods.

The Cornell Ecology computer software programs are designed particularly for improving these data analysis methods, and were used in the present analysis.

The ordination program DECORANA (detrended correspondence analysis, Hill 1979a) uses an algorithm that forces complete independence of axes by an iterative procedure using reciprocal averaging and detrending sample (plot) and species eigenvector scores (for a complete explanation, see Hill 1973, and Hill and Gauch 1980). TWINSPAN (two-way indicator species analysis, Hill 1979b) is a divisive and iterative classification method, which involves the identification of indicator or differential species having particular ecological preferences. The algorithm constructs an initial classification of samples, and uses this classification to obtain a grouping of species. Three sets of ordinations are carried out to derive the sample and species classifications, with each successive ordination being an improvement of the previous one. The two classifications are used together to obtain an ordered two-way table showing species-sample relationships. An "ideal" classification results in a table with species or plots on the left or right side of the table, and poor/indifferent indicators arranged in the middle.

DECORANA and TWINSPAN were carried out with and without nonvegetated plot components in the data set (See: Species List in Appendix V). Scatterplots for samples were constructed using DECORANA ordination scores on the first two axes. Default options (26 segments for detrending, and no down-weighting of rare species) and options using down-weighting and fewer segments (smaller data set) were used. Groups derived from the TWINSPAN tables were used to identify sample associations (clusters) on the DECORANA scatterplots. The DECORANA scatterplots for species did not show well-defined species groups (probably due to the presence of many uncommon species, or species with very low cover values), and are not included in this analysis.

Simple correlations and regressions were carried out between DECORANA axis scores (dependent variable) for plots and plot elevations. Scatterplots with best-fit lines were constructed. The correlation coefficient and multiple R-square values from these analyses give an idea of the association between ordination axes (scores) and elevations. The correlation and regression values were calculated by two techniques (i.e., both using and omitting nonvegetated categories from the data). Although slope, exposure and southness-

index values for some plots were available, too many missing data values for other plots prevented similar analyses from being carried out for other environmental factors.

Flora. Information on the composition of the marine flora of the study area was compiled during 15 visits to the intertidal wetlands between 1987 and 1989. In addition, an examination of selected portions of the near shore subtidal deepwater habitats (between 12 and 20 feet below MLLW) was made with scuba equipment. For purposes of sampling the marine flora, the shoreline was divided into ten segments of approximately 700 feet in length. The locations of specimens collected from the intertidal and subtidal areas were identified by segment number. The relative location within the intertidal area (high, low, mid) or subtidal depth in feet was recorded in addition to the nature of the substrate and the nature of attachment of the plant for each specimen collected. Identification of species was compared with voucher specimens contained in the marine algae collection housed at the Los Angeles County Museum of Natural History (LAM). In addition, the catalogue and checklist includes records of species collected by E. Yale Dawson within the study area from 1956-1959 as part of a water pollution study sponsored by the predecessor of the current State Water Resources Control Board. A catalogue of the species collected was prepared, and voucher specimens of all species were deposited in the UCSB Herbarium.

Checklists of vascular plants of the study area were compiled from observations and collections made during 15 field surveys conducted between 1986 and 1989, and from reports, publications, and selected herbarium specimens housed at the University of California, Santa Barbara (UCSB), Santa Barbara Botanic Garden (SBBG), and the California Academy of Sciences (CAS). A card file of specimen labels (PCF) of plants collected by Henry M. Pollard was also reviewed at SBBG for records of Ventura River plants. An annotated catalogue of plants was prepared from all available information and voucher specimens for many species were prepared and deposited at UCSB. Species of special interest that are (1) fully protected by Federal or State Law, (2) candidates for listing, or (3), identified as a species of special interest by public agencies, societies, and knowledgeable individuals were mapped and their habitat parameters were described. Invasive exotic weeds were identified and mapped, their habitat parameters were described, and alternatives for removal or control were proposed.

Management Opportunities and Interpretive Themes

Results of this study were analyzed with respect to the existing management plan for Emma Wood State Beach (California Department of Parks and Recreation 1975) and requirements set forth in our contract with the Department of Parks and Recreation. Specific topics of consideration included identification and management of unique areas for biological resources, alternatives for removal of invasive exotic plants, restoration potential for degraded areas, identification of interpretive themes and sites, and location of potential access areas (See: Management Opportunities - Figs. 53-55).

PHYSICAL ENVIRONMENT

Evaluation and discussion of various attributes of the physical environment are essential for the interpretation of the botanical resources of the study area. Selected aspects of the environment (e.g., topography, geology, climate, hydrology, etc.) that help define the integrity of the study area are summarized here.

Geologic History

The study area is situated in the structural feature known as the Ventura Basin, which is about 90 miles (145 kilometers) long and includes the Santa Barbara Channel between the Channel Islands and the Transverse Ranges and extends inland to the Soledad Basin near the San Gabriel Fault. This basin is famous for its extremely thick sequence of largely marine sedimentary rocks (Norris and Webb 1976), which exceed 58,000 feet (17,678 meters). The oldest rocks in the basin are Cretaceous (135-70 million years ago), and date to early subsidence of the region. Excluding the Santa Barbara Channel, the Ventura Basin was uplifted, folded, and faulted during the Pasadenan orogeny in middle Pleistocene (about 1 million years ago) (Norris and Webb 1976). The thick deformed strata provide nearly a complete record of the Cenozoic and Pleistocene history of coastal southern California (Putnam 1942). The Pasadenan orogeny produced the general topography that presently characterizes the Ventura Basin.

Deformation of the region has continued to the present, and today the San Buenaventura area occurs in the region of greatest rate of uplift in central and southern California (Lajoie et al. 1979). Regionally high uplift rates are estimated to be 13-33 feet (4-10 meters) per thousand years (Lajoie et al. 1979). This uplift and the intense folding and faulting are attributed to the ongoing north-south crustal compression that occurs south of the bend of the San Andreas Fault (Lajoie and Sarna-Wojcicki 1982). This compression has formed the Transverse Ranges characterized by such east-west trending structures as the Santa Ynez Mountains, which have their eastern limit in the vicinity of Ojai. Differential vertical uplift relative to sea level is responsible for the various cycles of erosion and for the formation of river and marine terraces in the region (Putnam 1942). Marine terraces along the coast west of San Buenaventura were cut during periods of high sea level between 5,000 (Holocene) and 120,000 (Pleistocene) years ago. One of

these Pleistocene marine terraces is more than 1,000 feet (305 meters) above present sea level, and is an indication of the magnitude of recent orogenic activity (Norris and Webb 1976). Three of the marine/river terraces can be seen in the background on Figure 4.

Recent investigations of the Ventura Mainland Shelf by Dahlen (1988) have provided additional insights into the relationship of regional topography and sea level. She found that seismic records also depicted Holocene marine terraces at depths of 151 feet (46 meters) below existing sea level. Dahlen (1988) concludes that the region is unique among California coastal areas because of the combined effects of tectonic activity, sea level fluctuations, and sedimentation associated with regionally high fluvial discharge.

Dates for river terraces in the Ventura Basin suggest that the Ventura River was formed before the Late Pleistocene, when its precursor established its present course by headward growth and capture of earlier drainage systems (Putnam 1942). At least six mappable river terraces were cut by the Ventura River during the last 60-80,000 years. These terraces are uplifted and folded over the Ventura Avenue Anticline; maximum uplift rates for some have been estimated at 0.2 inches (4-5 mm) per year for the past 32,000 years, and up to 0.6 inches (15-16 mm) per year 80-200,000 years ago (Dembroff et al. 1982). These rates of local deformation are among the highest in the world (Lajoie and Sarna-Wojcicki 1982). Terraces along the Ventura River illustrate that the present valley of the river is antecedent (i.e., the valley and terraces were formed before deformation took place), which is one of few such examples in the United States (Norris and Webb 1976). The older terraces have been variously deformed by the orogenic effect of the formation of the Ventura Avenue Anticline as evidenced by the tilted and folded erosional surfaces. The younger terraces exhibit less deformation.

Habitats in the study area have formed under these conditions of uplift, sea level fluctuation, and high rates of fluvial discharge. The natural disturbances associated with the environment are an important factor to consider not only in the classification and delineation of habitats, but also in the long range management of them. New predictions for sea level rise as a result of global warming (e.g., Barth and Titus 1984, California Energy Commission 1989, Ferren 1989, Titus 1988), must also be considered as part of any evaluation of the study area.

Climate

The Ventura County coast is characterized by a Mediterranean climate with mild, moist winters and moderately warm, generally rainless summers. Point Conception, which is located about 70 miles (113 kilometers) west of the study area, is considered a major climatic boundary in the region because it marks the approximate boundary between relatively cool, moist conditions to the north and the warmer and drier conditions to the east and south (Barbour et al. 1975).

The climate of the San Buenaventura region is influenced directly by the prevailing westerly transoceanic air currents. During winter months, however, the regional trend is for night and early morning offshore air movement driven by cooling of the adjacent land surface. The Ventura River Valley is a major cold air drainage that funnels cold air from higher montane elevations to the ocean. By afternoon, the prevailing westerly flow gives rise to light onshore winds, or occasionally winds that blow parallel to the coast. From November through March, occasional cyclonic storms may generate strong southeast to southerly onshore winds, followed for one or two days by brisk west to northwest winds. During spring months the typical daytime winds are similar but stronger than those of winter. Summer months are characterized by stable weather with calm morning conditions and light to moderate onshore air movement generated by interior convection, in the afternoon. During both fall and winter months, continental cooling and high pressure may generate warm, dry offshore winds ("Santa Ana" winds), especially at night, that can be strong in the Ventura Basin.

Coastal fog is an important characteristic of the study area. The coastline of southern California is subjected to an inversion layer that traps cool, moist air at low elevations, producing fog or low clouds during the night and early morning hours. As the inversion layer rises during the day, the fog evaporates. Fog develops most frequently during late spring and early summer mornings when warmer air comes in contact with the cool ocean water. Fog is then drawn over the land, a process usually associated with seasonal warming of the interior. The Ventura River Valley acts as a corridor through which moisture laden marine air moves inland. As ocean temperatures increase during the summer, the occurrence of fog decreases.

The average monthly temperatures for San Buenaventura range from 50 degrees Fahrenheit in January to 65 degrees Fahrenheit in August. This narrow seasonal range in temperature between the coolest and warmest months is characteristic of coastal California. The generally mild conditions with rare temperatures below freezing and above 100 degrees Fahrenheit are due in large part to the maritime location.

Precipitation in the San Buenaventura region has a Mediterranean pattern: winter rain and summer drought. The rain generally falls between October and March, and 75% of the runoff occurs from January through April (U.S. Army Corps of Engineers 1971). Mean annual precipitation near the mouth of the Ventura River is about 15.5 inches (40 cm). The higher mountains in the upper watershed receive about 40 inches (103 cm) annually and the average amount for the Ventura River Watershed is about 22 inches (56 cm). Some snow occurs in the higher mountains of the watershed, but snowmelt has no marked effect on the stream flow (U.S. Army Corps of Engineers 1971). Most rain-bearing storms come from the northwest in winter. Infrequent summer rains may occur from tropical air masses, but are generally of little consequence to plant growth.

In summary, the botanical resources of the study area are influenced by a regional climate that is characterized by coastal winds and morning fog, relatively consistently mild air temperatures that rarely dip below freezing, and variable, largely winter rainfall. Vegetation of the study area, however, is also influenced by additional factors such as periodic flooding and salinity.

Watershed and Physiography

The Ventura River Watershed (Fig. 7) drains the interior portions of the Transverse Range and extends 23 miles (36 kilometers) north from the Pacific Ocean. It is fan-shaped and includes a surface-water basin of 226 square miles (585 square kilometers) (U.S. Army Corps of Engineers 1971). Relief of the watershed is about 6,000 feet (1,829 m), extending from sea level at the river mouth to the crest of the higher peaks of the Transverse Ranges. Mountains and foothills of the watershed are generally underlain by sedimentary rocks, whereas valley bottoms are filled with shallow alluvium. The rugged topography of steep slopes and narrow canyons in upland areas has been produced by tectonic

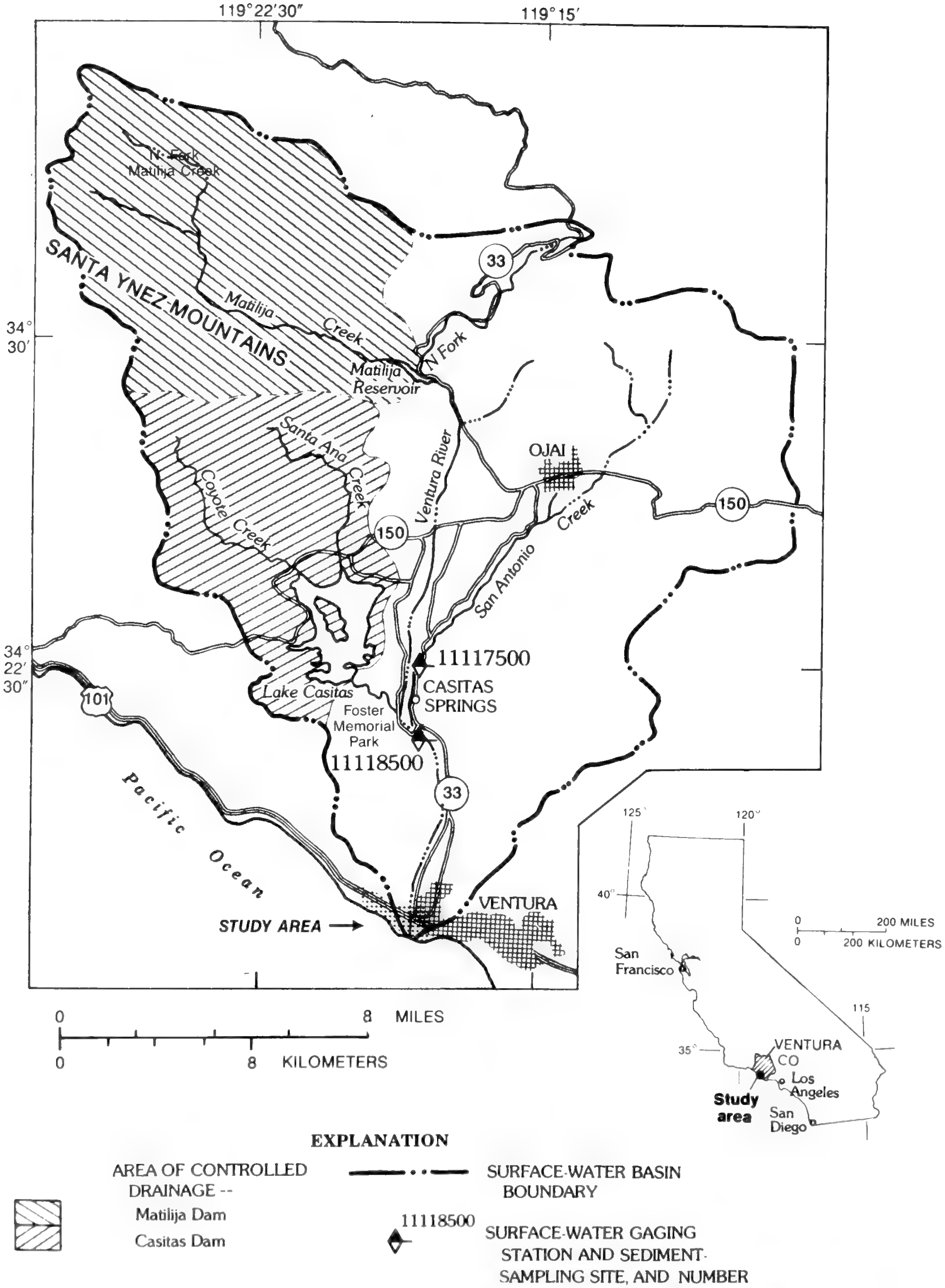

FIG. 7. THE VENTURA RIVER WATERSHED. The total area of surface drainage is 226 square miles; relief extends from sea level to about 6000 feet. Major subwatersheds include those for San Antonio Creek (Ojai Valley), Coyote Creek and Santa Ana Creek (Santa Ana Valley), and Matilija Creek. Figure adapted from Hill and McConaughy 1988.

processes and the differential erosion of bedrock types (Putnam 1942). The watershed region has been classified as 45% mountainous, 40% foothill, and 15% valley (U.S. Bureau of Reclamation 1954).

Major "subwatersheds" include those for San Antonio Creek in the Ojai Valley that flow into the Ventura River, Coyote and Santa Ana creeks that flow into Lake Casitas, and Matilija Creek that flows into Matilija Reservoir. The main trunk of the Ventura River extends south from the junction with Matilija Creek and the North Fork Ventura River and flows about 16 miles (26 kilometers) to the Pacific Ocean. The maximum width of the flood plain of the Ventura River is about 1 mile (1.6 kilometers) and the narrowest segment at Red Mountain (near Foster Memorial Park) is about 600 feet (183 meters). The average gradient of the river through the Ventura River Valley is 50 feet/mile (15 meters/kilometer).

The last two miles of the river basin are filled with shallow alluvium and were probably excavated to a lower depth during the late Pleistocene when sea level was lower (Putnam 1942). Unlike some coastal basins in southern California (e.g., Santa Clara Valley in Ventura County and Goleta Valley in Santa Barbara County), no submarine canyon occurs opposite the mouth of the Ventura River, apparently because the continental slope has a gentle rather than a steep gradient, and therefore none was cut during periods of lower sea level (Putnam 1942).

Drainage and Flooding

The Ventura River has a perennial flow to the estuary (comprised of rising ground water and waste discharges) and thus is an important source of water for biological resources as well as for the urban and agricultural development of the region. This perennial flow has been reduced significantly by various diversion projects (e.g., Robles and Foster Park Diversions on the Ventura River), and the quality of water has been impacted by effluents from numerous sources, including the Ojai Valley Sanitary District. Another major influence on the formation of habitats, however, is the seasonal and occasionally catastrophic winter floods that can significantly alter the path of the river channel, topography of the flood plain and delta, and location of estuarine wetlands.

Most of the floods are caused by winter storms and are described as "flashy" because peak flows occur a few hours after the heaviest rainfall and persist for a short period (U.S. Army Corps of Engineers 1971). Floods have occurred many times since the San Buenaventura mission was founded, including early recorded floods in 1832 and 1862 that caused severe damage in the old mission town (U.S. Army Corps of Engineers 1971). Floods that cause extensive damage have occurred about every 12 years; 26 floods of varying magnitude were recorded between 1862 and 1969 (U.S. Army Corps of Engineers 1971), and two additional floods (1978 and 1982) have occurred during the past 20 years.

Stream flow gauges were installed along the river in 1929 to measure the rates of flow and to determine the magnitude of flood events. In 1948, the U.S. Army Corps of Engineers completed a flood control levee along the lower 2.6 miles of the eastern side of the river down to the ocean as a protective measure for the western section of the City of San Buenaventura (U.S. Army Corps of Engineers 1967). Modern flood control maintenance practices and the levee are predicted to lessen the possibility of catastrophic flooding. The largest flood event between 1929 and 1971 occurred in 1969 and was recorded at 58,000 cubic feet per second (cfs), whereas the lowest flood flow was 11,000 cfs (U.S. Army Corps of Engineers 1971). Subsequent floods have not exceeded flows of 1969, although as a result of channel migration the floods of 1978 and 1982 caused more damage in some areas than those in 1969.

The 1969 event has been classified by the U.S. Army Corps of Engineers (1971) as a flood of about a 50 year frequency. They predict that floods of much greater magnitude can occur, in spite of reduced low flows resulting from reservoirs on Coyote and Matilija Creeks. For example, an Intermediate Regional Flood (i.e., one having an average frequency of occurrence once in 100 years) would have a peak discharge of 78,000 cfs at the mouth and an elevation of 21.8 feet above mean sea level (MSL) at the Main Street Bridge and 13.7 feet MSL at the Southern Pacific Railroad Bridge. Such a flood would cover the entire study area south of the Main Street Bridge (Fig. 8) because the highest elevation of the riverbed is 4 feet MSL and the highest elevation of the study area is about 17 feet MSL. A Standard Project Flood (i.e., a flood that may be expected from the most severe combination of meteorologic and hydrologic conditions that is considered reasonably characteristic of the geologic area, excluding extremely rare

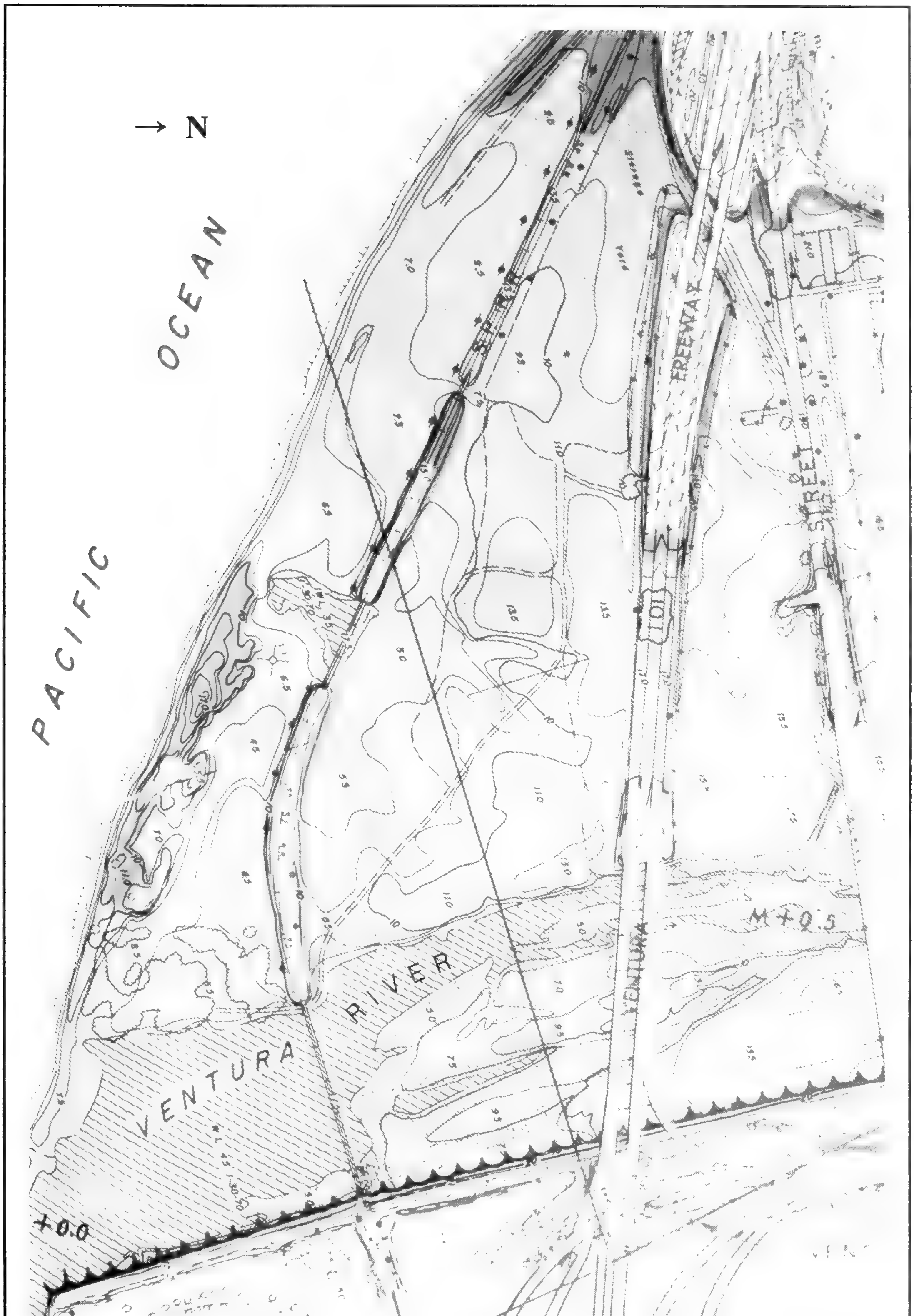

FIG. 8 VENTURA RIVER MOUTH: FLOODING POTENTIAL. Light gray area indicates predicted flooding zone for an Intermediate Regional flood (ca. 100 year occurrence). Dark gray area indicates predicted flooding zone for a Standard Project Flood (flooding from most severe combination of reasonably expected conditions). Figure adapted from U.S. Army Corps of Engineers (1971).

combinations that could produce the most severe situation known as the Probable Maximum Flood) would exceed the limits of the Intermediate Regional Flood and have elevations of 22.4 and 14.8 feet MSL at the Main Street and the Southern Pacific Railroad Bridges, respectively (U.S. Army Corps of Engineers 1971). Floods of these magnitudes could temporarily remove most of the vegetation of the region, greatly alter topography, and completely redefine the relationships of habitats and the composition and occurrence of the vegetation and flora. Flooding can also serve to rejuvenate the lower river by transporting and restoring various plant species that have been artificially removed. Floods of significantly lesser magnitude (i.e., 1969) have had similar effects (See: History in this report).

Soils

Soils and nonsoil substrates of the study area have been mapped and classified (Edwards et al. 1970) within several major types that are typical of river mouth environments of the region. They include riverwash, tidal flats, coastal beaches, Camarillo loams and sandy loams, and sandy alluvial land.

Riverwash occurs along and in the channel of the Ventura River and Estuary and consists of stratified, water-deposited layers of cobbly gravel, sand, and clay. This substrate is frequently flooded during and immediately after storms and is subject to scouring and deposition. Surface runoff is rapid and the erosion hazard is severe. The natural vegetation is usually dominated by hydrophytes such as willows; riverwash is not suitable for agriculture.

Tidal flats are periodically covered by tidal water and are highly stratified with thin layers of very fine sandy loam, silt loam, clay loam and clay (Edwards et al. 1970). This substrate is characterized by poor drainage, because of slow percolation and transmission of water, and has a high water table. The natural vegetation is dominated by hydrophytes and halophytes. Tidal flats are not suitable for agriculture.

Coastal beaches are characterized by sandy or cobbly substrates along narrow beaches and adjacent dunes of the Ventura River Delta. Some are covered by water during high tides and are subject to erosion by waves and wind. Permeability is generally rapid, drainage is excessive to poor, and fertility is low

(Edwards et al. 1970). Although much of this land is barren of vegetation, some dunes are colonized by native and introduced plants. Cobble areas subject to regular tidal inundation support a diverse and well developed marine flora. Coastal beach substrates may also contain riverwash and tidal flat substrates.

Camarillo soils in the study area are nearly level loams and sandy loams up to 4 feet (1.2 meters) thick that occur on alluvial plains adjacent to and largely west of the river channel and estuary (Edwards et al. 1970). Permeability is moderate and surface runoff is slow to ponded. The water table is generally within 2 feet (0.6 meters) and flooding from storm runoff is infrequent. The soils can contain soluble salts periodically. Soil fertility is high, but vegetation is limited by wetness and usually is dominated by riparian woodland and scrubland.

Sandy alluvial land contains stratified sandy sediment exceeding 3 feet (0.9 meters) in depth with gravels and cobbles in some areas, and occurs on portions of the flood plain generally east of the Ventura River channel (Edwards et al. 1970). This land is infrequently flooded immediately following storms of high intensity and long duration and can receive extensive scouring or deposition during flood conditions. Permeability of the soil is very rapid and the surface droughtiness and low fertility limits choice of agricultural activities. The natural vegetation is willows, cottonwoods, riparian scrub, and annual grasses.

Quantity and Quality of Low-Flow River Water

The quantity and quality of water reaching the lower Ventura River and estuary has been a controversial subject for several decades. Water diverted to the Casitas Reservoir for use by industrial, agricultural, and municipal users including the City of San Buenaventura, and effluent from sanitary treatment facilities are among many factors that impact plants and animals and their habitats.

Since 1958, the Casitas Municipal Water District has by-passed the first 20 cfs of low flow at the Robles Diversion on the Ventura River. This by-pass helps to sustain a surface flow in the river from Casitas Springs to the Ventura River Estuary, and supports a remnant Steelhead trout rearing habitat in the Casitas Springs area approximately seven miles upstream from the study area. Reduced flows can change the character of the riverbed, quality of surface water, and extent

and composition of the wetland vegetation. A conjunctive use agreement between the Casitas Municipal Water District and the City would have allowed the District to divert the entire low flow of the upper Ventura River into the Casitas Reservoir for storage and later use by the City. In 1988, an Appellate Court decision (subsequently sustained by the California Supreme Court) on a lawsuit filed by the Friends of Ventura River set aside the proposed conjunctive use agreement because the anticipated significant adverse effects on the Steelhead had not been adequately mitigated (California Court of Appeal 1988, California Supreme Court 1988). Such an agreement would also have had significant adverse effects on the biology of the Ventura River Estuary. Although this decision prevented additional major impacts to the Ventura River, the effects of depressed base flows and water pollution in the form of turbidity, nutrients, and various other contaminants continue to threaten the viability of the ecosystem. A recent study (James M. Montgomery 1990) concluded that the high nutrient content of the discharge water from the Oak View Wastewater Treatment Plant has caused an increase in plant growth, which in turn has resulted in a decrease in dissolved oxygen in river water where plant overgrowths occur.

Salinity and Tidal Flushing

Because salinity plays an important role in determining the composition of vegetation and in delineating wetland systems (e.g., riverine from estuarine), we recorded preliminary salinity readings and reviewed records from the Casitas Municipal Water District (Ternes 1989). A systematic monitoring program for the Ventura River Estuary, however, was beyond the scope of the present study. For general reference, salinity of sea water for the region is about 33 o/oo (parts per thousand), salinity of estuarine water is greater than 0.5 o/oo and may be hypersaline exceeding 33 o/oo, and that of river water is generally less than 0.5 o/oo of ocean-derived salts (Cowardin et al. 1979).

Ventura River Estuary. Unlike estuaries with a strong marine influence, which is caused by consistently open mouths and only seasonal freshwater runoff, the Ventura River Estuary is characterized by (1) short periods of tidal flushing when the mouth is open and longer periods of ponding and lagoon formation when the mouth is closed by a sandbar; and (2) a year round inflow of freshwater that is the result of upstream surface flows, rising groundwater, and the discharge of

effluent from the Ojai Valley Sanitary District. The precise contributions of each of these water sources varies from year to year, depending on rainfall and run-off patterns, and surface diversion and groundwater pumping rates. Because there is perennial freshwater runoff into the estuary, hypersaline conditions apparently are not reached at the surface of the estuary. The estuary is tidally flooded by brackish water when the mouth is open, and is flooded by slightly brackish or fresh surface water when the mouth is closed. Freshwater inflow also determines the depth of the estuary, the extent of areas flooded during ponding, and the pattern of salinity and temperature stratification (J. J. Smith 1987).

Evidence for alternating salinity conditions in the estuary is provided by salinity recorded occasionally between April 1988 and April 1989. When the sandbar blocking the mouth is removed by winter storm runoff, the estuary can remain open for extended periods through spring. Water at mean high tide (ca. 4 feet [1.2 meters] mean sea level) at the Southern Pacific Railroad bridge in April had a surface salinity ranging 13-17 o/oo and bottom salinities approximating 20 o/oo. During April high tide conditions, the Casitas Municipal Water District (Ternes 1989) observed that the bottom of the lagoon contained cooler, more saline water than did the surface. During conditions that approximate low tide in April, we observed surface salinities ranging from about 10 o/oo, in a pool behind the cobble berm partially closing the mouth, to 7 o/oo at the Southern Pacific Railroad bridge and 2 o/oo at the U.S. Highway 101. Salinities in the vicinity of the riffle marking the transition between riverine and estuarine conditions ranged from 1-2 o/oo at low tide conditions and were not distinguishable from riverine salinities upriver at the Main Street bridge. Further upriver between San Antonio Creek and Shell Road, the Casitas Municipal Water District recorded (Ternes 1989) June salinities ranging from 0.3-0.8 o/oo. Several recordings exceeded the generally accepted level of 0.5 o/oo ocean-derived salinity used to distinguish freshwater riverine conditions from estuarine conditions, suggesting that natural runoff from the watershed may be slightly saline or that effluent discharged to the river might be saline.

Under summer and fall conditions of reduced runoff, a sandbar usually closes the mouth and tides are prevented from flushing the estuary. Perennial low-flow runoff, however, fills the estuary temporarily creating a nontidal estuary with surface water elevations that extend to about 6 feet (1.8 meters) mean sea level

and generally exceed water levels reached at high tide, creating a seaward hydraulic head. Initial stratification of the lagoon is reflected by July and August salinities that are reduced to about 9 o/oo and 8 o/oo at the surface, but remain high at 31 o/oo and 27 o/oo on the bottom, respectively. Although the mouth does open periodically during the summer, the sand/cobble bar eventually returns and the estuary fills again. October surface salinities have been recorded at about 2 o/oo for the entire length of the estuary. In fall 1989, however, surface salinity decreased to approximately 0.00 o/oo even behind the sand/cobble bar, as a result of prolonged mouth closure and subsequent lack of tidal flushing by saline water. Based on limited sampling by our team and as reported by Ternes (1989), under combined spring high tide conditions and summer lagoonal conditions, surface water was slightly warmer (17-25 degrees C), less saline (2-18 o/oo), and slightly more basic (pH 7-8) than bottom water, which was slightly cooler (15-25 degrees C), more saline (15-30 o/oo), and slightly more acidic (pH 6-7).

Recent research on small, central coastal, California estuaries indicates that the pattern of salinity and temperature stratification can vary significantly with the amount and pattern of freshwater inflow to the estuary (Smith and Robinson 1986, Smith 1987). After formation of the sand/cobble bar at these estuaries, freshwater inflow "rides" on the surface of the lower brackish water until continued inflow converts the estuary to freshwater by forcing salt water out of the estuary through the bottom of the sandbar. The gradual conversion of the surface water at the Ventura River Estuary from estuarine to fresh water (0.00 o/oo) during the summer and fall of 1989 was accompanied by the expansion of freshwater plant species (e.g., *Ludwigia uruguayensis*) into the lower Ventura River Estuary, and the appearance of other freshwater species (e.g., *Eclipta alba*) along the lagoonal side of the sandbar. J. J. Smith (1989) also asserts that the relative depths of the fresh and salt water layers are biologically important because the lower salt water can act as a solar collector (depending on thickness and duration of the salt water layer) that results in increased temperatures at lower depths. His studies in other estuaries have demonstrated that this increase in temperature is sufficient to impact rearing habitat of juvenile Steelhead trout by reducing food supplies and growth rates. Lack of mixing also can result in the depletion of dissolved oxygen in the lower saline layers. Reduced freshwater inflows as a result of droughts or water diversions can increase the potential for layering, and thus reduce the potential use of estuaries as Steelhead rearing sites. Because of the importance of

the Ventura River Estuary to the resources of the study area and the dynamic nature of the hydrologic system, additional systematic monitoring of runoff, sandbar breaching, and salinity and temperature stratification is necessary to better understand how the estuary functions and to identify management options.

<u>**Second Mouth Estuary of the Ventura River**</u>. West of the Ventura River Estuary, a smaller estuary persists at the Second Mouth Estuary of the Ventura River. This alternate route of the river is only flushed by runoff during catastrophic floods. The Second Mouth Estuary can also receive marine water when storm waves top a cobble and sand berm that otherwise blocks a connection between the ocean and estuary. Under these conditions, wetlands at the Second Mouth Estuary are classified somewhat arbitrarily as estuarine. However, a small, permanently flooded habitat created by the interaction between topography and high water table occurs south of the Southern Pacific Railroad and exhibits interesting hydrological characteristics. Unlike many coastal ponds and swales of the region, desiccation of this flooded habitat does not occur, apparently because of the persistent high water table. The relationship between the water table and river is particularly noticeable when the Ventura River Estuary is in the lagoonal state, which apparently results in raising the water table throughout the Ventura River Delta and causes fluctuations in the water level of the Second Mouth Estuary.

Surface salinities recorded in this smaller estuary in April range from 9 o/oo at the topographically higher, seaward (southern) end, to 13 o/oo at the lower, landward (northern) end. At the same time, salinities in a smaller, adjacent but isolated and topographically higher pool reached 27 o/oo. This high salinity might have resulted from a recessed water table that continually replenished water only in the larger pool, whereas evaporation exceeded replacement of water and caused salinity to rise in the smaller pool. These conditions occurred when the mouth of the Ventura River was open and lagoonal conditions with higher, ponded water did not occur. Salinities measured at the Second Mouth Estuary in October ranged from 13-14 o/oo at the southern end and 15-16 o/oo at the northern end. There were no isolated pools with high salinity because a high water table, perhaps associated with lagoonal conditions in the Ventura River Estuary, flooded more of the habitats and hydrologically connected previously isolated areas.

The preliminary salinity sampling suggests that at least under the current cycle of drought conditions and without flushing of the Second Mouth Estuary by catastrophic flooding, salinities may be slightly less in spring than in fall even though the water table tends to be high in the summer and fall. Furthermore, salinities tend to be slightly higher in the topographically lower, more deeply flooded, landward portion of the habitat than at the higher, more shallowly flooded, seaward portion.

Intertidal Marine Wetlands. The entire coastline of the study area is formed by the delta of the Ventura River, and consists of intertidal marine wetlands and subtidal marine deepwater habitats. Incoming tides cover the wetlands with water at salinity 33 o/oo. The sands and cobbles of the delta serve as an aquifer that holds large amounts of fresh and brackish water, particularly when the mouth of the estuary is blocked and a lagoon is formed that raises the water table.

Because of the porous nature of most of the deltaic sediments, water continually flows from the seaward margins of the delta into the marine environment. This is observable at low tide when water can be seen seeping from the sand and cobble berm along the shoreline. Salinities measured under these conditions reveal this seep water is not just marine water absorbed into the beach, but is brackish water from the estuary and water table that flows through the substrate. Low tide salinities measured in April at the mouth of the Ventura River Estuary and at the base of the cobble berm ranged from 5-10 o/oo and increased in salinity seaward to 25 o/oo before incoming waves flushed the area with marine water. In October when the estuary was closed and full, water seeping from the base of the berm in the vicinity of the Second Mouth Estuary ranged from 10 o/oo in tide pools to 23 o/oo at various seeps and pools throughout the intertidal zone, except in the lower zones where saline water of waves mixed with water draining from higher in the marine wetlands. The result of this relationship between a seeping deltaic reservoir and tidal flushing is a marine wetland quite different from those rocky intertidal zones west of the study area where salinities remain as high as marine water. Brackish conditions in the marine wetlands could have a profound influence on the biota of the habitats, but the investigation of this phenomenon is beyond the scope of the present study.

Comparison with other Estuaries. There are at least four types of southern California estuaries: 1) mouths of large rivers with brackish lagoons (e.g., Ventura River Estuary); 2) mouths of canyons (e.g., Devereux Slough) with euryhaline (fluctuating salinity) lagoons; 3) bays (e.g., San Diego Bay) with extensive tidal marshes, open water channels, and largely euhaline (sea water conditions); and 4) geologic structural basins (e.g., Carpinteria Salt Marsh) with steep watersheds, much sedimentation, and saline to hypersaline (exceeding sea water) conditions.

The biota of these estuaries often reflect the salinity and tidal regimes characteristic of each type, and thus comparison of the Ventura River Estuary with other types is useful. Ferren et al. (1987) and Davis et al. (1990) report a very different type of lagoonal estuary at Devereux Slough. As with the Ventura River Estuary, Devereux Slough is closed by a sandbar for most of the year; however, Devereux Slough fills with runoff from winter storms and only opens during brief periods in the winter when it empties the ponded water and is flushed by tides for up to one or two weeks before it closes again. Because of a lack of perennial runoff, evaporation exceeds groundwater replenishment of estuarine water and the estuary gradually becomes hypersaline during summer and autumn with salinities reaching as much as 84 o/oo and typically exceeding 40 o/oo in a small permanently flooded portion of the lagoon near the mouth. Thus, unlike the Ventura River Estuary, Devereux Slough becomes hypersaline during the summer when extensive salt flats are exposed as water evaporates from the lagoon; whereas the Ventura River Estuary fills with perennial freshwater runoff and may remain slightly brackish through much of the summer and autumn, depending on the amount of freshwater inflow and the breaching pattern of the sandbar.

In the geologic structural basin type of estuary, another set of physical conditions prevail. Although the mouths of these estuaries also can be occasionally blocked by a sandbar, they are open to the ocean more often and thus receive inundation by sea water at more frequent intervals. The mouth of Carpinteria Salt Marsh is maintained by revetment, which prevents mouth closure under most conditions and permits regular flushing by tides. The general lack of dry season runoff, other than low-flow agricultural runoff in channels, rarely influences mud flats, which apparently remain saline or slightly hypersaline. The irregularly flooded upper marsh wetlands are characteristically hypersaline from late spring through fall (Ferren 1985).

The tidal and nontidal water regime and brackish to nearly freshwater salinity regimes of the Ventura River Estuary undoubtedly have profound effects on the biota of the system, including the composition and extent of the vegetation. Brackish marsh vegetation rather than salt or freshwater marsh vegetation is the expected dominant type under these variable conditions.

Habitats

The term "habitat" as used herein is an area or environmental feature having a certain combination of physical and/or biological attributes that result in it supporting a distinctive association of plants at a particular point in time. Plant habitats in the vicinity of the Ventura River Estuary are influenced by a wide variety of factors that include, for example, topographic relief, water regime, salinity regime, substrate, density and seasonality of vegetation, climate and weather, and disturbance.

Associated with these factors is the relationship between habitat characteristics and both long-term (e.g., geological) and short-term (e.g., seasonal) changes that take place in the study region. Long-term changes have included, for example, emergence of the watershed, changes in sea level, deposition of deltas, and loss of wetlands to urbanization. Short-term changes include annual climatic fluctuations, and the opening or closing of the mouth of the estuary. Changes in the vegetation and flora of the study area have been in response to the various long-term and short-term changes in the habitats that illustrate the dynamic aspects of wetlands at the mouth of the Ventura River.

Classification of the vegetation of the study area wetlands (Appendix I) is based in part on the classification of habitats. A primary consideration is the distinction between wetland and upland types. For wetlands, we utilize the definition in Cowardin et al. (1979):

> "Wetlands are lands transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water. For the purpose of this classification, wetlands must have one or more of the following attributes: (1) at least periodically, the land supports predominantly hydrophytes; (2) the substrate is predominantly undrained hydric soil; (3) the substrate is nonsoil and is saturated with

water or covered with shallow water at some time during the growing season of each year."

All other habitats are upland types, or transitional types that are not grouped easily into categories of one or the other. Transitional types often occur at disturbed sites around the margins of estuaries and on flood plains.

Wetland habitats include numerous intertidal and nontidal types, and vegetated and nonvegetated types. Subtidal deepwater habitats occur in the nearshore waters adjacent to intertidal wetlands in the study area. The wetlands and deepwater habitats can be grouped into four systems (Cowardin et al. 1979) in the vicinity of the mouth of the Ventura River.

The *Marine System* occurs seaward of the dunes, dune swales, and estuary and includes nearshore subtidal deepwater habitats and intertidal wetlands on the shallow continental shelf and coastline, where salinities usually exceed 30 o/oo (locally at about 33 o/oo). Wetlands along the intertidal cobble and sand margin of the Ventura River Delta and adjacent nearshore subtidal deepwater habitats dominated by marine algae and angiosperms are included within the study area.

The *Estuarine System* includes habitats commonly referred to as coastal salt marshes, bays, and tidal channels, and consists of subtidal deepwater habitats and intertidal wetlands usually confined to coastal embayments or other physiographic features that are open to the ocean at some point during the year, receive freshwater runoff, and are flooded by water with an annual low-flow salinity greater than 0.5 o/oo from ocean-derived salts. Estuarine wetlands and subtidal deepwater habitats at the Ventura River Estuary and Second Mouth Estuary are included in the study area.

The *Riverine System* occurs in river and stream channels and includes deepwater habitats and wetlands (submerged by less than two meters of water) that are characterized by nonpersistent (above-ground annual) plants when vegetated, and are flooded by water with an average annual low-flow salinity less than 0.5 o/oo from ocean-derived salts. The exposed channel margins and permanently flooded channel of the Ventura River belong to this system and occur upriver from the Ventura River Estuary.

The *Palustrine System* includes wetlands that are characterized by persistent plant types (perennial emergents, shrubs, trees) when vegetated and that are flooded by water with an average annual salinity less than 0.5 o/oo from ocean-derived salts. If nonpersistent (above-ground annual) vegetation occurs, the habitat is not a riverbed or streambed. In the study area, Palustrine Wetlands include dune swales, freshwater marsh, and scrub/shrub and forested wetlands. A description of the habitats in the three study sites is presented below.

Emma Wood State Beach - Ventura River Group Camp. Upland habitats in this portion of the study area include ruderal areas such as railroad berms, road banks, campground sites, dunes and other sites characterized largely by upland plant species. Wetland habitats include: 1) marine intertidal cobble and sand shores and subtidal substrates; 2) estuarine intertidal mud, sand, and gravel flats, slopes, and bars, and estuarine subtidal ponds and channels in the Ventura River Estuary and at the Second Mouth Estuary; and 3) palustrine swales, banks and flood plains. Habitats transitional between wetland and upland types occur in topographically high areas of the flood plains.

Seaside Wilderness Park. The lower Ventura River Estuary is the primary feature of this portion of the study area, which includes many estuarine habitats similar to the upper estuary at the Ventura River Group Camp; however, more intertidal flats and subtidal channels occur in the Park. The mouth of the estuary provides a greater marine influence to this area than the upper estuary, because of its proximity to marine habitats. Palustrine habitats include exposed cobble channels and swales. Extensive ruderal areas that include planted trees (e.g., Monterey Cypress) are transitional between wetland and upland habitat types and include swale and flood plain habitats. Minor occurrences of dunes, and some banks provide upland plant habitats.

Hubbard Property. This site is characterized by the transition between estuarine, riverine, and palustrine habitats and includes: 1) estuarine intertidal banks and flats and subtidal channels; 2) bars, riffles and shores transitional between estuarine and riverine habitats; 3) riverine exposed shores and channels and flooded channels; and 4) palustrine exposed shores, beds and flood plains. Habitats transitional between wetland and upland types occur in topographically high areas of the flood plains and support a mixture of wetland and upland species.

LAND USE HISTORY

The coastal area of Southern California, in which the present Emma Wood State Beach and Seaside Wilderness Park are situated, has been occupied by humans for at least the past 6000 years (Rogers 1929, Landberg 1965, Greenwood 1976). This occupation has affected the vegetation in the study area in various ways, but the most significant impacts have resulted from agricultural operations over the last 150 years, and more recent urban developments during the last 75 years.

The following chronological narrative provides an outline of some of the more significant changes in human land uses in the study area and the immediately surrounding area. This account is based on a review of historical maps and aerial photographs, as well as materials from contemporary historical accounts.

Native American Occupation: ca. 6000 B.C. to ca. 1542 A.D.

The abundant natural resources associated with the Ventura River (fresh water, fish, waterfowl, plants, and mammals) and surrounding ocean frontage (shellfish, marine mammals, and fish) provided important material and food sources for the Native Americans (Chumash) who occupied the area (Heizer and Elasser 1980). There is a small recorded pre-historic site (VEN-196) within the study area, and a larger site (VEN-481) on a bluff overlooking the Ventura River Mouth. Additionally, there are several other recorded Native American sites in the immediate area whose occupants undoubtedly made use of the natural resources associated with the Ventura River and coastline (Greenwood and Browne 1969). The small site in the study area is believed to have been occupied only seasonally, perhaps as a chipping station. The larger site, situated above the flood plain of the Ventura, was a major village of the early aboriginal period. One estimate indicates the Chumash population near San Buenaventura at 400 at the beginning of the Spanish period, while the total Chumash mainland population has been estimated at 20,000 (Cook 1976a). By the end of the Mission period (1833), the population was estimated to be about 8,000, and by the end of 1880, it had been reduced to less than 50 individuals (Cook 1976b).

The Native Americans of the Southern California coast were largely hunter-gatherer-fisher people, with coastal tribes relying heavily on the harvesting of marine resources (Hudson and Blackburn 1979). Plank canoes used for ocean fishing and transport are thought to have been made from pine or fir that grows at higher elevations beyond the study area and surrounding region (Hudson 1970). Some plants in the study area, however, were an important source for basket making materials, including Basket Rush (*Juncus textilis*). Aside from the areas occupied by the pre-historic sites, there is little evidence to suggest that Native Americans significantly altered the pattern or extent of the native vegetation of the study area through agricultural or hunting practices.

Early European Development: The Spanish Period, 1542-1822

The coast of Ventura County was first visited by Juan Rodriguez Cabrillo in 1542. Reports from this expedition refer to a densely vegetated river that is believed to have been the Ventura River. A second Spanish expedition in 1602 by Sebastian Viscaino also recorded the presence of a substantial stream in the region. It was not until Gaspar de Portola's land expedition into upper California in 1769, however, that Spanish settlers began to colonize the mainland coast of California. It was during this expedition that the future site of the San Buenaventura Mission was noted, but it was not until 1782 that the Mission was founded by Father Junipero Serra.

The first substantial impacts to the native vegetation occurred with the founding of the mission. Land was cleared for building sites, and to accommodate the Mission's agricultural fields (Englehardt 1930). In addition, tree species (e.g., sycamores, oak, etc.) may have been exploited for building materials. At about the same time, the first diversion of the Ventura River began upstream in the vicinity of Foster Park (Browne 1974). Most of the development, however, was confined to the east side of the Ventura River, as indicated by the U.S. Coastal Survey map of 1855 (Fig. 9). At this time, the riparian forest was broken only by two small agricultural fields, and a cleared area labeled "Indian Rancho" (Fig. 9). The introduction of cattle by both the Mission authorities and neighboring Spanish ranchos may also have impacted native vegetation in the study area, through grazing and the introduction of nonnative species such as the Field Mustard (*Brassica rapa*).

Early European Development: The Mexican Period, 1822-1848

California became a territory of the newly created nation of Mexico in 1822. The transfer from Spanish to Mexican control had little immediate effect on the growth and development of the area. The Mission agricultural lands were in decline prior to the revolt of Mexico, and declined still further with the secularization of the Mission lands in 1833 (Englehardt 1930).

In 1846, Governor Pio Pico granted to Ramon Rodriguez the land known as Rancho San Miguelito, consisting of approximately 9000 acres west of the Ventura River, and encompassing the present Emma Wood State Beach. The land was used primarily for ranching and farming. Agricultural activity, however, did not begin to intensify until spurred by the California Gold Rush in 1849. It was during this period that the first significant agricultural impacts occurred to the vegetation on the west side of the Ventura River Delta.

Early American Development: 1848-1900

Following the defeat of Mexico by the United States, California became a state in 1850. The U.S. Government formed a land commission to decide the validity of claims to land under Mexican deeds, and maps were drawn to establish ownership. Lands not confirmed to owners were opened for claims by Americans, and the remaining land was open to homesteading under the National Homestead Act of 1862. After 1849, the San Buenaventura area experienced considerable expansion of agriculture. By 1870, the entire east side of the lower river flood plain had been converted to agriculture. Structures were built on the east side of the Ventura River Estuary, and the open body of water noted in Figure 9 had been reduced in size. The western flood plain, including the study area, remained largely undeveloped (U.S. Coastal Survey 1870). The period from 1849 to 1870 was the period of the California Ranchos when large herds of cattle were grazed on open, unfenced fields and undeveloped lands (Cleland 1969). This practice most probably intensified impacts to the vegetation of both the eastern and western portions of the Ventura River Delta.

The extension of the Southern Pacific Railroad line across the Ventura River Delta and Estuary in 1887 was the first major urban intrusion into the west

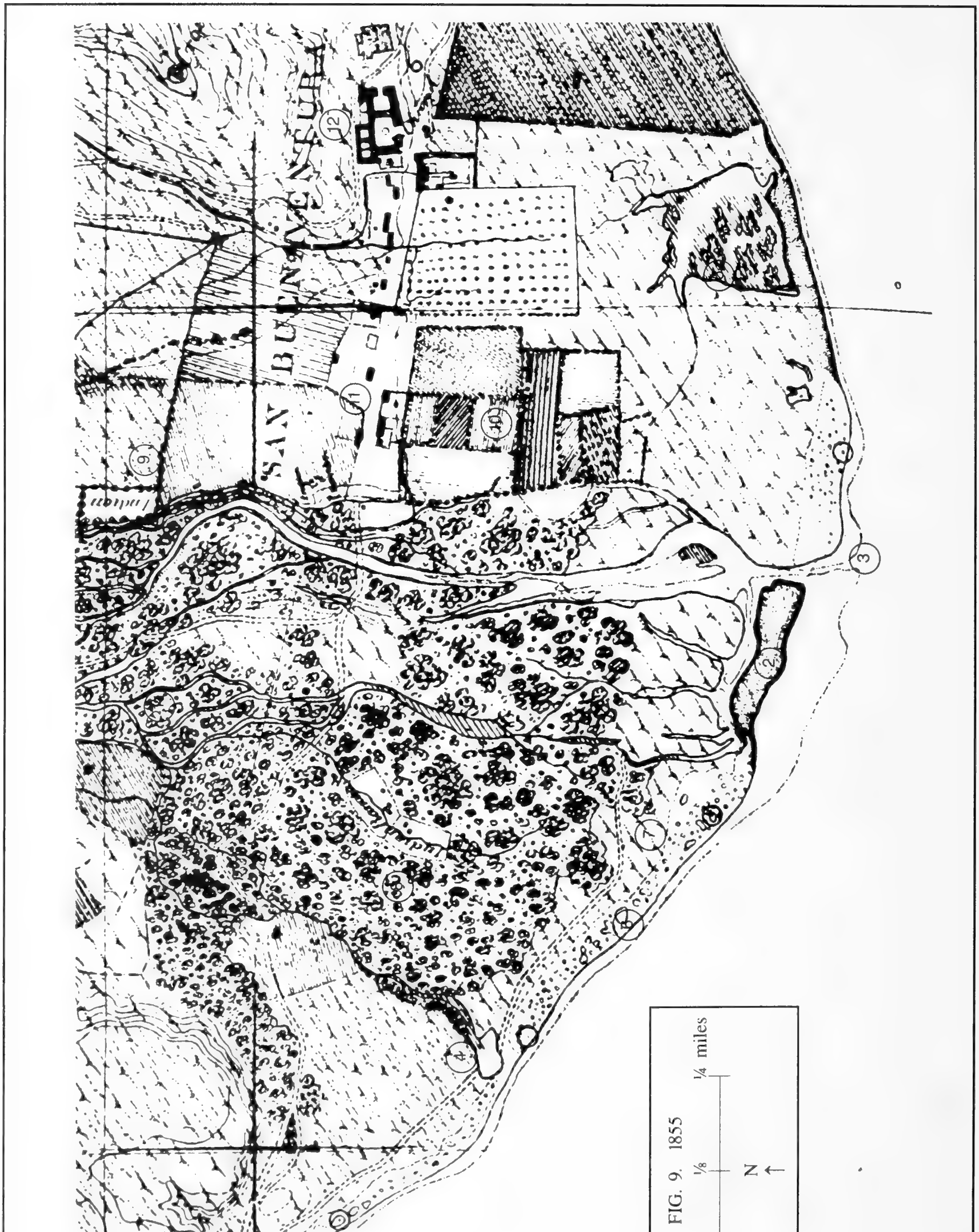

FIG. 9. 1855

FIG. 9. EMMA WOOD STATE BEACH AND VENTURA RIVER STUDY AREA: U.S. Coast Guard Survey Map, 1855. Salient features of the Study Area and vicinity are described below.

1. **Braided Distributary Channels.** Distributary channels of main Ventura River channel forming fan-shaped Ventura River Delta.

2. **Ventura River Estuary.** West arm of the main Ventura River Estuary with distributary channels. Note large sand spit nearly closing off estuary to the Pacific Ocean.

3. **Ventura River Mouth** Narrow mouth open to the Pacific Ocean.

4. **Small Coastal Lagoon.** Separated from the Pacific Ocean by dunes and fed by distributary channels of the Ventura River.

5. **Large Coastal Lagoon.** Separated from the Pacific Ocean and the main Ventura River Estuary by dunes and wetlands and fed by distributary channels of the Ventura River. Note open water of lagoon is partially broken up by emergent vegetation.

6. **Southern Coastal Dunes.** Vegetated and unvegetated dunes fringe Ventura River Delta along the Pacific Ocean.

7. **Dune Swale Wetlands.** Extend inland from the back of Southern Coastal Dunes to the riparian forest.

8. **Riparian Forest.** Covers the broad floodplain of the Ventura River Delta, cut by braided distributary channels of the Ventura River.

9. **"Indian Ranchos."** Located in the riparian forest, on the west side of a distributary, and on the east side of the main Ventura River channel. Note cleared areas surrounding small structures (dwellings?).

10. **Agricultural Fields.** Row crops and orchards situated southwest of San Buenaventura.

11. **San Buenaventura.** Note Main Street extends westward as a dirt road across the "San Buenaventura River" and through the riparian forest. This road marks the approximate northern limit of the study area.

12. **Mission San Buenaventura** and associated buildings and agricultural fields.

side of the Ventura River Delta (Robinson 1955). Except for the bridges over the main Ventura River channel and the Second Mouth Estuary, the railroad line was constructed on an earthen berm approximately 50 feet wide at the base. The line required the filling in and displacement of a portion of the various riparian habitats; it also required the filling of wetland habitats in the vicinity of the Second Mouth Estuary of the Ventura River. The berm also served as a dike diverting sheet flood flows through the double spanned trestle constructed over the Second Mouth Estuary (Fig. 10).

In 1870, an 8000-acre portion of the San Miguelito Rancho was sold to Green B. Taylor who developed an expanded agricultural and cattle ranching operation on the property. The elevated marine terraces and the upper flood plain terraces were cleared of most of the remaining native vegetation, including the area south of the Southern Pacific Railroad line. The principal crops were lima beans and fodder for cattle. The ranch was also used for sheep grazing during the 1880's. These activities further impacted the native vegetation of the area by direct grazing, the removal of vegetation for crop production, and the introduction of invasive exotic vegetation.

Modern American Development: 1900-Present

After Green B. Taylor's death in 1900, the Taylor Ranch property passed to his widow, Nancy Taylor, and was then passed on to subsequent heirs. Under the Taylors, the ranch came to be used principally as a cattle feed lot until 1971 when the operation was discontinued. The existing single truss railroad bridge over the main Ventura River Estuary was constructed in 1909; a double truss bridge was constructed in 1914 over the Second Mouth Estuary of the Ventura River.

Around the turn of the century, a tract of land bordering the west and east sides of the Ventura River Estuary (now known as the Seaside Wilderness Park and the Ventura County Fairgrounds) was acquired by E. P. Foster for the purpose of creating a "miniature Golden Gate Park." In 1909, the land was deeded to the County of Ventura. In 1913, the area then called Ventura County Seaside Park was planted with Monterey Cypress, Monterey Pines, Eucalyptus, and Date Palms (Fig. 11). Efforts to complete the park, however, were abandoned as a result of the Great Depression (San Buenaventura 1989). Although the park provided a

popular picnic area, camping sites displaced a major portion of the dune and coastal scrub vegetation that was originally on the site. Later development of the Ventura County Fairgrounds also eliminated the wetland habitats that extended from the east side of the Ventura River Estuary, downcoast at least as far as Figueroa Street.

The discovery of major deposits of oil in the 1920's in the Ventura River Valley, and subsequent development of the Ventura Avenue Oilfields in 1925 (Fig. 10), impacted primarily aquatic vegetation through the discharge of oilfield wastes, such as drilling muds and brines, into the Ventura River.

In 1932, the current Main Street Bridge (replacing an earlier bridge) was constructed across the Ventura River and its major distributaries (Fig. 10). The Main Street Bridge further divided the Ventura River Delta, but was designed to clear span the major distributaries as well as the main channel of the Ventura River. The bottom lands continued to be farmed, including portions on the south side of the Southern Pacific Railroad.

In 1942, after the entry of the United States into World War II, a small Coast Artillery Battery unit was established at the mouth of the Ventura River (Marmor n.d.). The battery consisted of two cannons mounted on circular tracks in the dunes, rifle range, barracks, and an access road through the back side of the Southern Coastal Dunes west of the Ventura River Estuary. A tent camp, mess hall, ammunition dump, and other facilities were erected within the Monterey Cypress/Pine grove. The facility was manned for only two years, but impacted the coastal habitats, resulting in substantial disturbance to coastal dune and dune swale vegetation. Remnants of the facilities (including the gun mountings, building foundations, and fragments of the asphaltum road) are still evident in the dunes and Monterey Cypress/Pine grove (See: Botanical Resources - Extirpated Species; Southern Coastal Dunes).

In 1944, the granddaughter of Green B. Taylor, Emma Wood, died and left the Taylor Ranch to her husband, Adrian Wood. Following Wood's death, the Ranch was passed on to his heirs.

FIG. 10. 1938

FIG. 10: EMMA WOOD STATE BEACH AND VENTURA RIVER STUDY AREA: Oblique aerial photograph, 1938. Salient features of the Study Area and vicinity are described below.

1. **Braided Ventura River Channel.** Note absence of stream-side vegetation and exposed gravel and sand bars due to scouring from two previous years of above average rainfall and runoff.

2. **Main Street Bridge.** Present bridge constructed across the Ventura River in 1932. Note bridge spans major distributaries (marked by temporarily abandoned but vegetated channels). Also, Ventura River levee at east end of Main Street Bridge has cut off east branch of Ventura River channel.

3. **Southern Pacific Railroad.** Railroad line extended across the Ventura River Delta on a raised berm. Originally constructed in 1884. Construction of railroad has broken up and isolated portions of the Ventura River Delta habitats, particularly wetland habitats.

4. **Southern Pacific Railroad Bridge.** Present bridge constructed in 1909 over the main Ventura River Estuary. Note levee at east end of the trestle has cut off eastern distributary of the Ventura River leading to the large coastal lagoon noted in Fig. 9.

5. **Double Railroad Trestle Bridge.** Present bridge constructed in 1909 over "Second Mouth" (west branch) of the Ventura River. Note open water lagoon and flooded lower ends of distributary channels forming east and west branches of the lagoon on the north side of the two trestles.

6. **Ventura County Fair Grounds.** Constructed on the wetlands and large lagoon east of the main Ventura River Estuary.

7. **Municipal Sewage Ponds.** Built on the east bank of the Ventura River Estuary, near the ocean outlet to the estuary.

8. **Ventura Avenue Oil Fields.** Oil production was initiated in the early 1920's by tapping the Ventura Avenue Anticline which runs transversally across the lower Ventura River Valley.

9. **Seaside Wilderness Park.** Grove of introduced Monterey Cypress and Monterey Pine on the west side of the Ventura River Estuary (now part of Seaside Wilderness Park). Note the grove is separated from the main river channel and estuary by a low vegetated area.

10. **Agricultural Operations.** Agricultural fields established on Ventura River alluvium, and on elevated marine cut terraces. Note remnant isolated stands of forested riparian vegetation.

11. **Ventura River Estuary.** Note that the sandbar at the river mouth has been pushed seaward of the general trend of the coastline as a result of the high winter flows during the previous two years. (Compare Figs. 11 and 13.)

12. **Intertidal Marine Flora.** Note the pattern of marine algae and surf-grass growing on the intertidal and subtidal cobble substrate fringing the Ventura River Delta.

13. **City of San Buenaventura.** The original pueblo has expanded out from the San Buenaventura Mission to occupy the east side of the floor of the Ventura River Valley composed of alluvium from the Ventura River.

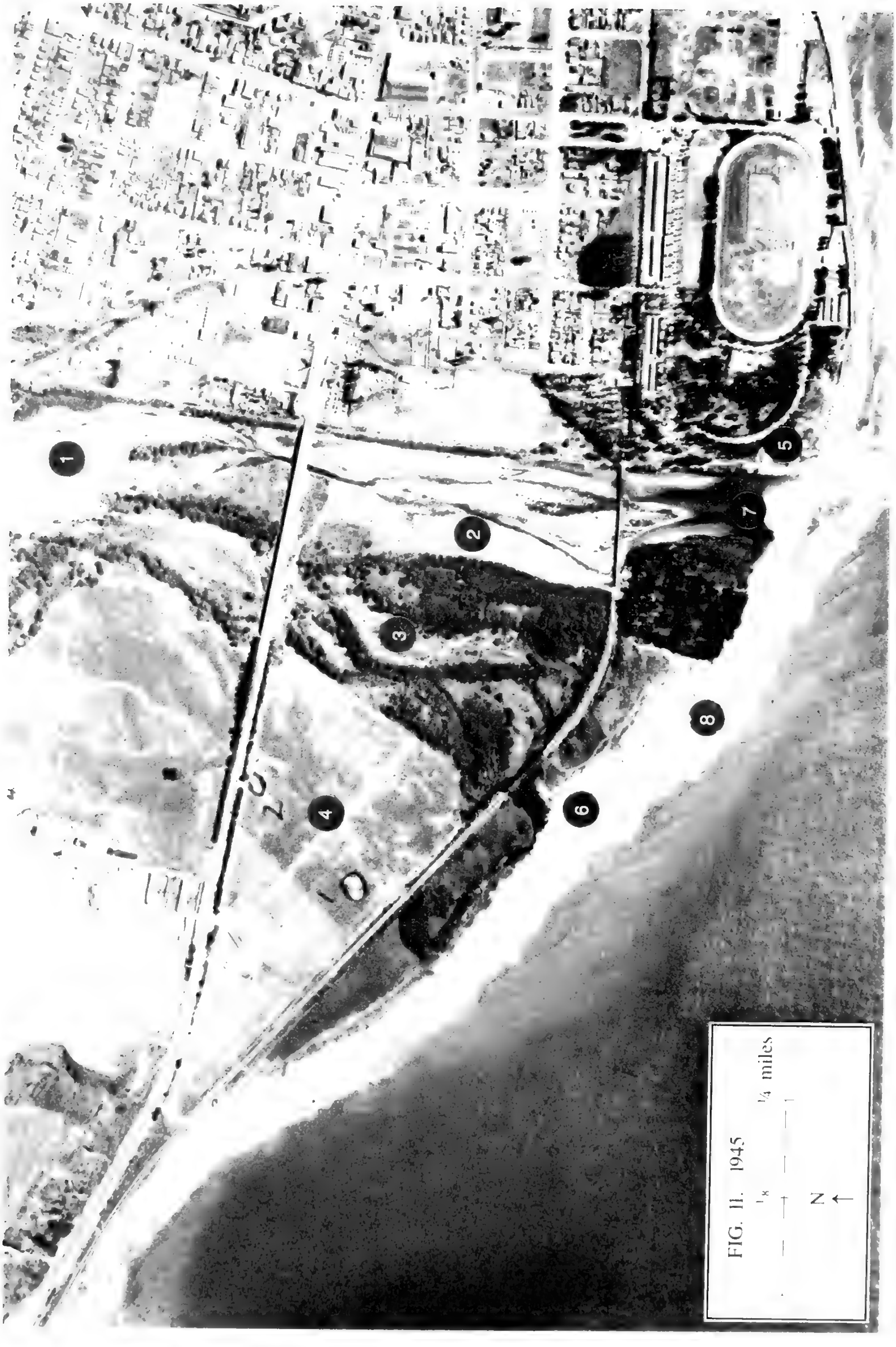

FIG. II. 1945

FIG. 11: EMMA WOOD STATE BEACH AND VENTURA RIVER STUDY AREA: Aerial photograph, 2 November 1945. Salient features of the Study Area and vicinity are described below.

1. **Braided Ventura River Channel.** Note absence of stream-side vegetation and exposed gravel and sand bars due to scouring from above average rainfall and runoff during 1942-3 water year.

2. **Agricultural Operations.** Agricultural field on alluvial terrace between the main Ventura River channel and remnant riparian forests. Note unpaved access road.

3. **Riparian Forest.** Temporarily abandoned distributary channels are densely vegetated with riparian forest. Note distributary channels lead to east and west arms of the coastal lagoon at the second mouth (west channel) of the Ventura River.

4. **Expanded Agricultural Operations.** Enlarged agricultural field on west side of the Ventura River encroaches onto remnant riparian forested areas. Note eastern edge of agricultural field extends in a straight line from the west end of the Main Street Bridge to the west end of the Southern Pacific Railroad double trestle over the second mouth coastal lagoon. (Hand lettered circled areas indicate water well sites.) Isolated remnant stands of forested riparian vegetation have been removed for agricultural purposes. Agricultural field on south side of Southern Pacific Railroad line appears to be abandoned and in an early stage of successional recovery.

5. **Ventura River Levee.** A short rock revetment levee has been constructed on the east side of the Ventura River Estuary south of the Southern Pacific Railroad Bridge to protect the Ventura County Fairgrounds. Note remnant stand of Southern Coastal Dunes is present at the south east corner of the Ventura County Fairgrounds near the mouth of the main Ventura River Estuary.

6. **Southern Coastal Dunes.** Note the lack of vegetated cover on the dune complex as a result of World War II gun implacements and related support facilities.

7. **Ventura River Estuary.** A marine delta has begun to form landward of the sand spit reflecting the decline of runoff during summer and fall. (Compare Figs. 10 and 13.)

8. **Gun Implacements.** Two World War II cement gun implacements are visible on the dunes. They are now located on the beach because shoreline erosion has resulted in the loss of dune habitat. (Compare Figs. 12 and 13.)

By 1945, the agricultural operations on the southern side of the Southern Pacific Railroad had been abandoned, but the upper flood plain between the railroad and the Main Street Bridge on the west side of the Ventura River was still being used for dry farming of lima beans and fodder crops (Fig. 11). In addition, the area immediately adjacent to the river between the Southern Pacific Railroad and the Main Street Bridge was put under cultivation. In 1948, a permanent levee was constructed by the U.S. Army Corps of Engineers on the east side of the Ventura River from the mouth of the river upstream approximately 2.6 miles (4.2 kilometers) (U.S. Army Corps of Engineers 1967). The levee was faced with upgrouted sandstone rock, and was designed to withstand a Standard Project Flood (ca. 150,000 cubic feet per second). The levee effectively eliminated both the river's influence on the east side of the Ventura River Delta and the potential flooding of the City of San Buenaventura and the Ventura County Fairgrounds.

The Matilija Dam was completed in 1948 on Matilija Creek, a major tributary of the Ventura River. The reservoir was designed with an original storage capacity of 7000 acre feet, but has since been reduced to approximately 1100 acre feet as a result of siltation and lowering the dam. In 1958, the Casitas Dam (with storage capacity of 254,000 acre feet) was constructed on Coyote Creek, a major tributary of the Ventura River, along with the Robles Diversion (with a diversion capacity of 500 cubic feet per second) on the main branch of the Ventura River. Both of these projects have altered the flow regime of the lower Ventura River, though they have not eliminated catastrophic flood flows (U.S. Army Corps of Engineers 1971).

In 1960, the Southern Pacific Milling sand and gravel operation was established on a 150 acre (61.7 hectare) site within the flood plain of the Ventura River, approximately 1 mile (1.5 kilometers) upstream from the Main Street Bridge. At about the same time, the Ojai Valley Sanitary District wastewater treatment plant (which currently processes 2.1 million gallons per day of municipal and industrial waste water from the Ventura River and Ojai valleys) was constructed on the Ventura River approximately 5 miles (8.1 kilometers) upstream from the mouth of the Ventura River. These developments have further impacted the vegetation of the study area by removing native vegetation and increasing the spread of invasive exotic vegetation, and have contributed to the loss of submerged aquatic vegetation through the discharge of pollutants into the Ventura River (See:

Botanical Resources - Species of Special Interest and Extirpated Species).

Between 1962 and 1964, the U.S. 101 Freeway was constructed across the Ventura River Delta between the Southern Pacific Railroad and the Main Street Bridge. Unlike the Main Street Bridge, the new crossing did not completely clear span the distributaries of the Ventura River Delta. Instead, the western half of the crossing was built on fill material a few feet above the grade of the Ventura River flood plain. The crossing further dissected the habitats of the Ventura River Delta and resulted in additional fill on the riparian forest vegetation (Fig. 12). The land south of the Southern Pacific Railroad was purchased by the Crown-Zellerbach Corporation in the mid 1960s. In preparation for a proposed residential development, the area was graded and levelled, including the Southern Coastal Dunes bordering the site. In 1967, the OST Pipe storage yard was established in the area between the Southern Pacific Railroad and the Main Street Bridge in the area now occupied by the Emma Wood State Beach-Ventura River Group Camp facilities. Previously the site had been used to graze cattle and occasionally to grow fodder; as a result, the native vegetation was largely replaced by nonnative grasses and forbs.

In 1969, the County of Ventura transferred the area now known as Seaside Wilderness Park to the City of San Buenaventura. The same year an oil and gas line was laid along the inland side of the Southern Pacific Railroad right-of-way; as a result, the majority of the open water area of the Second Mouth Estuary was filled. Subsequently, in 1971, a 150 foot section of the double railroad trestle was removed and replaced with a berm, thus eliminating all but a remnant of the open water area.

Between 1971 and 1974, the California Department of Parks and Recreation expanded the Emma Wood State Beach holdings by purchasing an approximately 80 acre (32.4 hectare) triangular piece of the Ventura River Delta (including the Crown-Zellerbach parcel) that is bounded on the east by the Ventura River levee, on the north by the U.S. 101 Freeway, and on the south by the Pacific Ocean (Fig. 13). The original plan of the area provided for a 550 car recreational vehicle lot situated in the area of the Second Mouth Estuary wetlands. The plans were substantially revised, however, to limit the developments to a 35 car day-use parking area and a 124 person tent group camp facility located west of

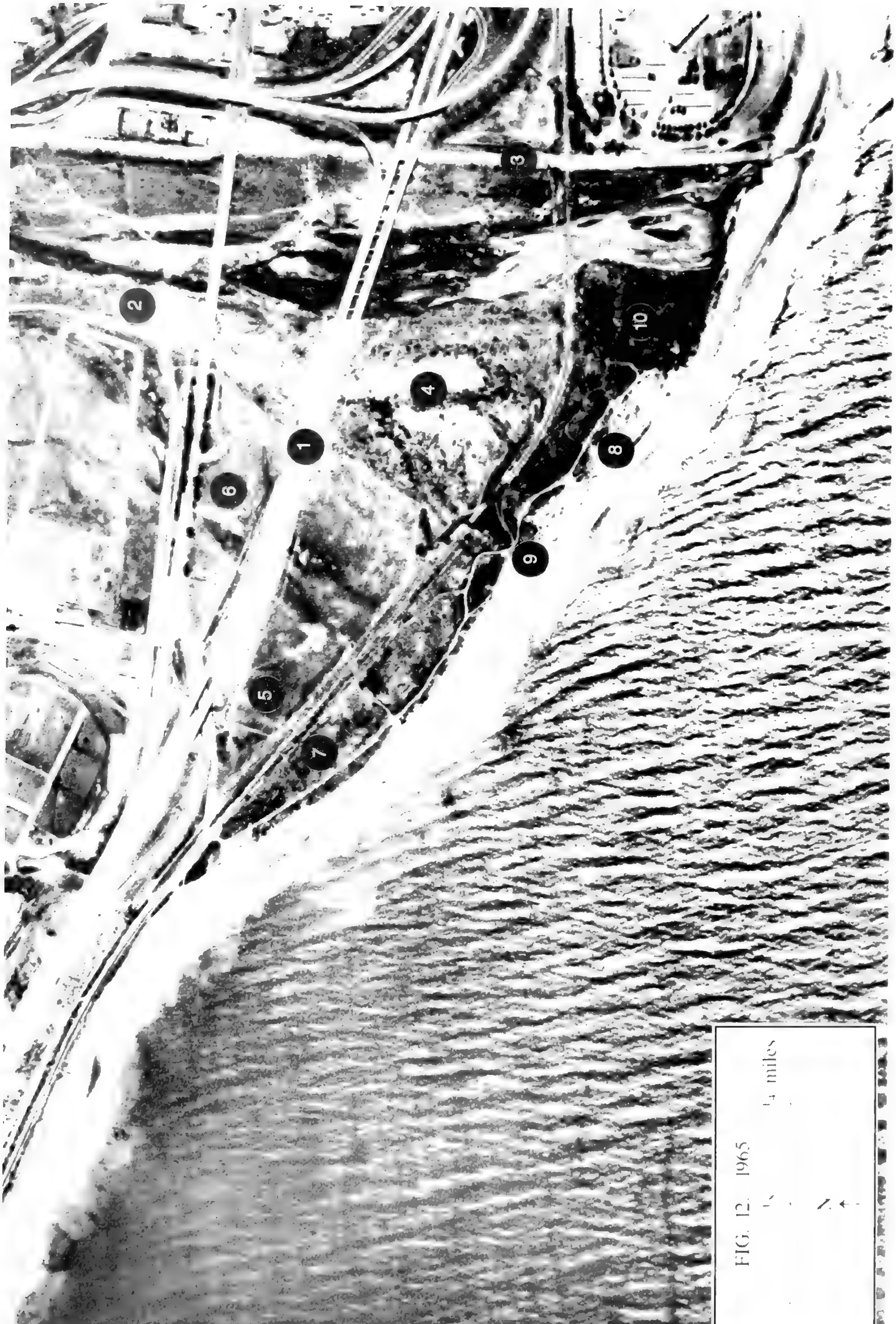

FIG. 12. 1965

FIG. 12: EMMA WOOD STATE BEACH AND VENTURA RIVER STUDY AREA: Aerial photograph, 1965. Salient features of the Study Area and vicinity are described below.

1. **U.S. Highway 101.** Constructed in 1964 between the Main Street and the Southern Pacific Railroad alignments. The Highway further breaks up the habitats of the Ventura River Delta. Note the U.S. Highway 101 Bridge does not fully span the major distributaries of the Ventura River (marked by vegetated temporarily abandoned channels), but relies on a "dry weather" crossing built a few feet above the grade of the Ventura River floodplain.

2. **Access Road.** A private access road has been constructed from the south side of the Main Street bridge along the west side of the Ventura River, north of the Main Street Bridge, isolating forested riparian vegetation from the Ventura River channel.

3. **U.S. Army Corps of Engineer Levee.** An ungrouted rock-revetted levee was constructed in 1948 along the lower 2.6 miles of the east side of the Ventura River, protecting the City of San Buenaventura, including the Ventura County Fairgrounds.

4. **Riparian Forest.** The density of the riparian forest on the west side of the Ventura River Delta has been substantially reduced as a result of agricultural activities, and periodic scouring from heavy flooding. Distributaries, however, are still discernable as more densely vegetated, temporarily abandoned river channels. The agricultural field noted in Fig. 11, between the riparian forested floodplain and the west bank of the Ventura River and between the Southern Pacific Railroad Bridge and the Main Street Bridge, has been abandoned, and is in an early state of successional recovery.

5. **Future Ventura River Group Camp Site.** Agricultural activity on the parcel between the Southern Pacific Railroad and U.S. Highway 101 has ceased and the area is in an early state of successional recovery. This parcel was subsequently used as a pipe storage yard in the late 1960s prior to being purchased by the State Department of Parks and Recreation.

6. **Hubbard Property.** Agricultural activity between the U.S. Highway 101 and Main Street has ceased and is in an early stage of successional recovery. This parcel was subsequently reconverted to agriculture in the early 1980's prior to being developed as a recreational vehicle park.

7. **Agricultural Operations.** Agricultural activity on the parcel between the Southern Pacific Railroad and the Pacific Ocean was abandoned by 1945 and is in a later stage of successional recovery. (Compare Figs. 10 and 11.)

8. **Southern Coastal Dunes.** Dunes occur along the fringe of the Ventura River Delta. Note the dunes vegetation is dissected by pedestrian trails, and the unpaved vehicular road along the back side of the dunes.

9. **Second Mouth Coastal Lagoon.** The second mouth coastal lagoon consists of an open body of water created by the intersection of the ground surface with the high water groundwater table. Note the east and west arms of the lagoon on the north side of the Southern Pacific Railroad trestle.

10. **Seaside Wilderness Park.** The grove of Monterey Cypress is beginning to thin as a result of the loss of trees. Also, the land area to the immediate east of the grove has been lost due to erosion from the Ventura River.

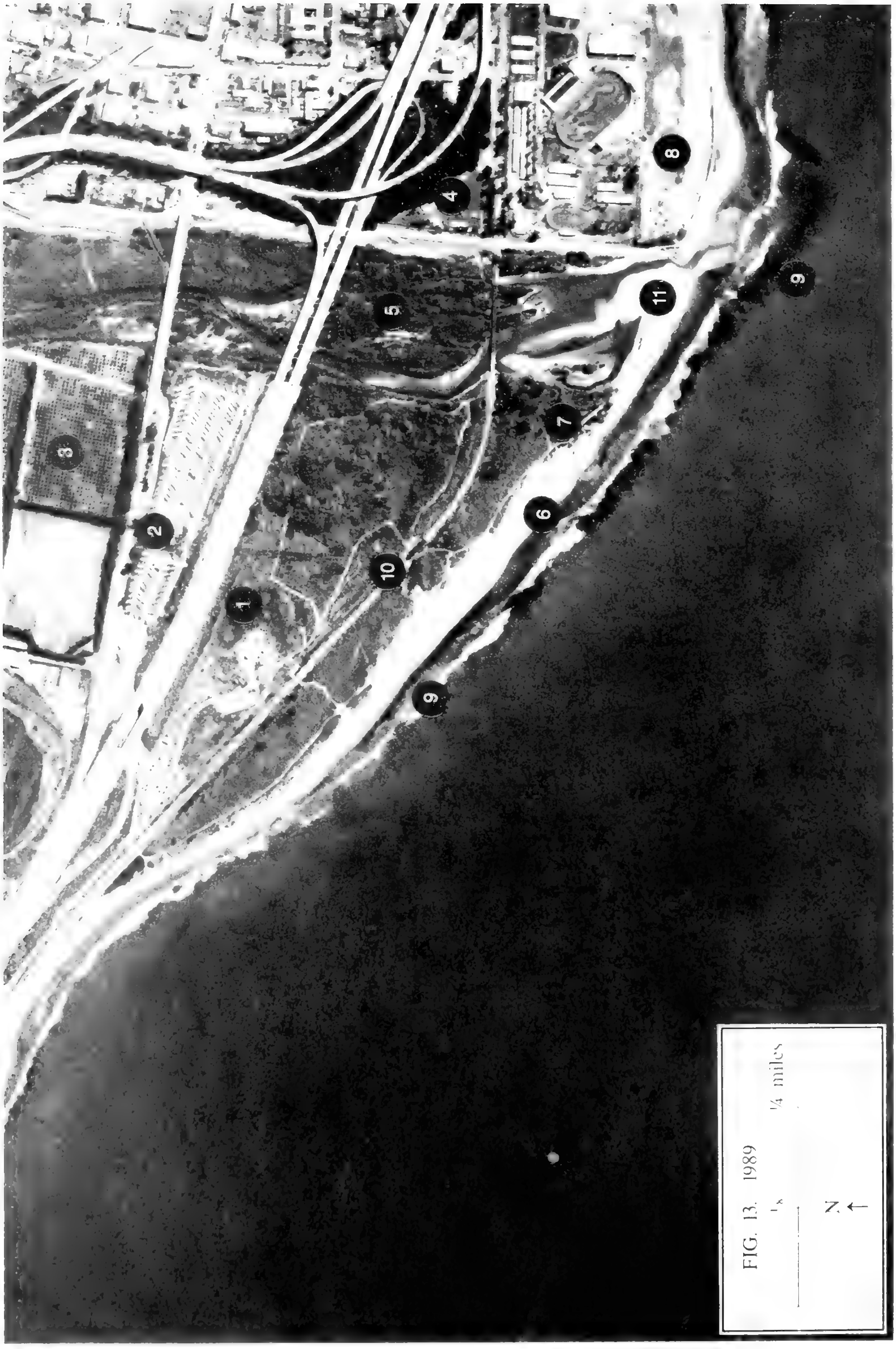

FIG. 13. 1989

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FIG. 13: EMMA WOOD STATE BEACH AND VENTURA RIVER STUDY AREA. Aerial photograph, 15, February 1989. Salient features of the Study Area and vicinity are described below.

1. **Emma Wood State Beach–Ventura River Group Camp.** The Ventura River Group Camp facilities were constructed in 1982 on lands that were originally riparian forest, but subsequently converted to agriculture, and then briefly used as a pipe storage yard. Note the unpaved service roads leading from the Group Camp through the riparian forest and remnant wetland area north of the Southern Pacific Railroad and through the coastal lagoon, salt marsh and Southern Coastal Dunes on the southern side of the Southern Pacific Railroad.

2. **Ventura Beach R.V. Resort.** The recreational vehicle park was constructed in 1987. Note that the eastern ¼ of the facility is built within the spans of the Main Street Bridge and within the flood easement of the Ventura Country Flood Control District.

3. **Agricultural Operations.** Agricultural land north of the Main Street Bridge on the west side of the Ventura River has been planted with Avocado trees and Eucalyptus wind breaks. Note also the areas to the west of the access road that have been planted with avocados, thus encroaching further onto the riparian forested vegetation.

4. **CalTrans Maintenance Yard.** The yard was constructed in 1967 and is serviced by a storm drain that discharges directly to the upper Ventura River Estuary.

5. **Ventura River and Floodplain.** A dense forested riparian vegetation has been reestablished as a result of the lack of scouring by runoff during the current three year drought. Reduced flood control maintenance activities due to the loss of local revenues has also contributed to the reestablishment of the riparian forested vegetation.

6. **Southern Coastal Dunes.** The dunes along the fringe of the Ventura River Delta have been largely denuded as a result of increased pedestrian traffic generated since the development of the Emma Wood State Beach-Ventura River Group Camp. (See Fig. 12.)

7. **Seaside Wilderness Park.** The grove of Monterey Cypress and Monterey Pine has been almost completely eliminated as a result of aging, vandalism, and disease. Also, the land area occupied by the grove has been reduced due to erosion from the Ventura River. (Compare Figs. 10, 11, and 12.)

8. **Ventura County Fairgrounds.** Note the cleared site of the over-flow parking area immediately adjacent to the east side of the Ventura River Estuary and the cobble tidepools. This area has since been developed with a 328 car parking lot, which has made the environmentally sensitive habitats readily accessible to a substantially larger number of people.

9. **Intertidal and Subtidal Marine Flora.** Note the distinct patterns of marine algae and surf grass growing on the intertidal and subtidal cobble substrate which fringes the Ventura River Delta.

10. **Second Mouth Coastal Lagoon.** The lagoon has been reduced to a small area of permanent open water surrounded by wetland vegetation subject to annual temporary flooding. The larger open water lagoon shown in earlier figures has been reduced as a result of (a) the removal of one of the two trestles and the extension of the railroad berm; (b) the installation of an oil/gas pipeline along the northern side of the railroad berm; and (c) the construction of a State Park access road and footpath under the remaining railroad trestle.

11. **Ventura River Estuary.** Note large marine delta, consisting of marine sand, has developed in the estuary as a result of the lack of high flows during the past three years of below average rainfall and runoff. (Compare Figs. 10 and 11.)

the active Ventura River distributaries in the area previously occupied by the OST pipe storage yard. The facilities were completed in 1982. Although the facilities did not displace any additional native vegetation, they introduced increased human activity into the study area and surrounding region. Furthermore, the maintenance operations developed for the park resulted in the cutting of dirt roads through portions of the estuarine wetland at the Second Mouth Estuary and through the remnant riparian forest between the Southern Pacific Railroad line and the U.S. 101 Freeway. The increased pedestrian traffic generated by the park facilities has had a marked effect on the remnant Southern Coastal Dune vegetation that occurs on the south side of the Southern Pacific Railroad. As a result of the popularity of this area for sun-bathers and strollers, most of the dune vegetation has been eliminated, and the dunes appear to be migrating inland, covering portions of the adjacent dune swale and wetland vegetation (Compare Figs. 11 and 13).

In 1987, the Ventura Beach R.V. Resort recreational vehicle park was constructed between the U.S. 101 Freeway and the Main Street Bridge (Fig. 13). The area had been stripped of its native coastal scrub vegetation for agricultural development several years prior to its development with recreational facilities. A portion of the park was built within the spans of the Main Street Bridge and inside the easement of the Ventura County Flood Control District; as a result, the facility is subject to periodic flooding from the Ventura River. The east end of the facility is immediately adjacent to the existing riparian vegetation, and within an area that had previously supported riparian vegetation because of its soils and hydrology.

In 1989, the Ventura County Fairgrounds completed a 328 car parking lot along the beach front extending from Figueroa Street to the Ventura River levee. This area had been previously inaccessible to automobiles except for special Fairground events. Prior to the construction of this parking lot, pedestrian access to the study area and the western Ventura River Delta had been effectively controlled through the entrance kiosk at Emma Wood State Beach-Ventura River Group Camp. With the construction of the parking facilities, the area is now readily accessible to vehicles and those using recreational equipment such as wind surfers, jet skis, etc. The increased traffic will undoubtedly further increase impacts to estuarine wetlands and to the dune vegetation on the sandbar at the mouth of the Ventura River Estuary and the Southern Coastal Dunes at Emma Wood State Beach.

Summary

In summary, until the mid 1960's the study area had been primarily impacted by agricultural operations and the two transportation corridors created by the Southern Pacific Railroad and the Main Street Bridge. With the construction of the U.S. 101 Freeway across the Ventura River Delta, the Study Site has been subjected to increasing pressures from urbanization. The Ventura River and levee has acted as a relatively stable urban-rural boundary separating the habitats of the western half of the Ventura River Delta from the City of San Buenaventura to the east. The acquisition of the Ventura River Group Camp has served to protect a majority of the study area from further urban encroachments. However, the surrounding area is increasingly subject to urbanization as evidenced by the recent construction of the private recreational vehicle park and Ventura County Fairgrounds parking lot, and the proposed construction of a campus of the California State University System on a portion of the Taylor Ranch.

Despite the extensive and repeated disturbance to the native vegetation of the study area, many of the plant habitats have remained intact, and some plant communities have naturally reestablished when left undisturbed. This phenomenon is particularly evident for plant communities such as Riverine Wetlands (aquatic bed and emergent) and Palustrine Wetlands (riparian scrub and riparian woodlands) that are naturally subjected to periodic disturbance from flooding (See: Botanical Resources - Riverine Wetlands and Deepwater Habitats; Palustrine Wetlands; and Extirpated Species).

BOTANICAL RESOURCES

The botanical resources of the study area include the native, naturalized, and cultivated vegetation and flora observed during this 1987-1989 investigation.

Vegetation Classification and Mapping

The vegetation of coastal wetlands, particularly estuaries, of southern California has been investigated by various authors (e.g., Macdonald and Barbour 1974, Henrickson 1976, Macdonald 1977, Zedler 1982). Other investigators have reported on the vegetation of particular estuaries such as upper Newport Bay (Vogl 1966), Tijuana Estuary (Zedler 1977, 1986), Carpinteria Salt Marsh (Ferren 1985), Devereux Slough (Ferren et al. 1987), Goleta Slough (Ferren and Rindlaub 1983), and Mugu Lagoon (Onuf 1987). Studies of riverine and riparian vegetation are fewer and include, for example, portions of the Goleta Valley (Ferren 1983) and the southern California coastal area (Faber et al. 1989).

For the present study, we classified upland vegetation (Appendix I) using Holland (1986) and wetland vegetation using a modified scheme by Cowardin et al. (1979). This modified scheme is consistent with a preliminary classification of southern California wetlands developed by Ferren (1989). We mapped the vegetation (Appendices II-IV) using aerial photographs associated with extensive field work and sampled it along transects and in plots (See: Quantitive Analysis of Vegetation, and Appendix V). Aspects of the vegetation are described below, more complete species lists for vegetation units are presented in Appendix I, and infraspecific taxa and additional information regarding the species are presented in the Annotated Catalogue (Appendix VI) and Checklist (Appendix VII) of Marine Algae and the Annotated Catalogue (Appendix VIII) and Checklist (Appendix IX) of Vascular Plants. Wetlands and deepwater habitats are discussed in the order of occurrence in the Classification (Appendix I). Many of the vegetation categories are displayed on the maps (Appendices II, III) and are illustrated (Figs. 14-30). A map of selected exotic vegetation or species is presented in Appendix IV.

UPLANDS. Because repeated natural disturbance (e.g., catastrophic flooding), and artificial disturbance (e.g., trails) are significant factors in determining the content and composition of vegetation at the Ventura River

Mouth, we found it difficult to delineate consistently many upland from wetland habitats and vegetation. This situation is characteristic of impacted coastal areas. For the purposes of our study, we restrict the application of upland to habitats and vegetation that has not been characterized by repeated flooding or saturation and that supports a predominance of upland species. Dunes and dry coastal bluffs are examples. We have included in wetlands those habitats and vegetation consistent with the definition by Cowardin et al. (1979) (See: Physical Environment - Habitats) and transitional areas on flood plains that support both upland and wetland species (See: Botanical Resources - Wetlands).

Southern Coastal Dunes. This vegetation (Figs. 14-16) is best developed in the study area south of the Southern Pacific Railroad at Emma Wood State Beach-Ventura River Group Camp (Appendix II). The dunes here reach an elevation of about 10-17 feet (3-5.2 meters) above MSL and are composed of aeolian (wind-blown) sand derived from beach deposits (Cooper 1967). A profile of habitats and vegetation from the railroad south to the beach (Fig. 14) illustrates the relationship between marine habitats south of the dunes and dune swale wetland north of the dunes.

Characteristic species on low foredunes include native herbaceous species such as Beach-bur (*Ambrosia chamissonis*) and Whiteleaf Saltbush (*Atriplex leucophylla*) and at least one common naturalized species, Sea Rocket (*Cakile maritima*). Partially stabilized dunes support a greater number of natives including the herbaceous species, Beach Evening Primrose (*Camissonia cheiranthifolia* ssp. *suffruticosa*), Beach-bur, Spectacular Fiddleneck (*Amsinckia spectabilis*), and Beach Morning-glory (*Calystegia soldanella*), and the shrub Coast Goldenbush (*Isocoma veneta*), which is most common along the transition between dune and dune swale wetland. Hottentot Fig (*Carpobrotus edulis*) is a succulent invasive exotic that is colonizing some dune habitat, reducing the amount of habitat that could support native plants. Extensive dune erosion and unlimited pedestrian access by State Beach visitors also threaten native vegetation. No stabilized dune habitats have formed in the study area, and thus Coastal Dune Scrub is not a component of the vegetation. However, beach cobble deposited by storm tides provides a narrow upland habitat along the southwestern coast of the Group Camp and supports many of the species characteristic of Southern Coastal Dunes.

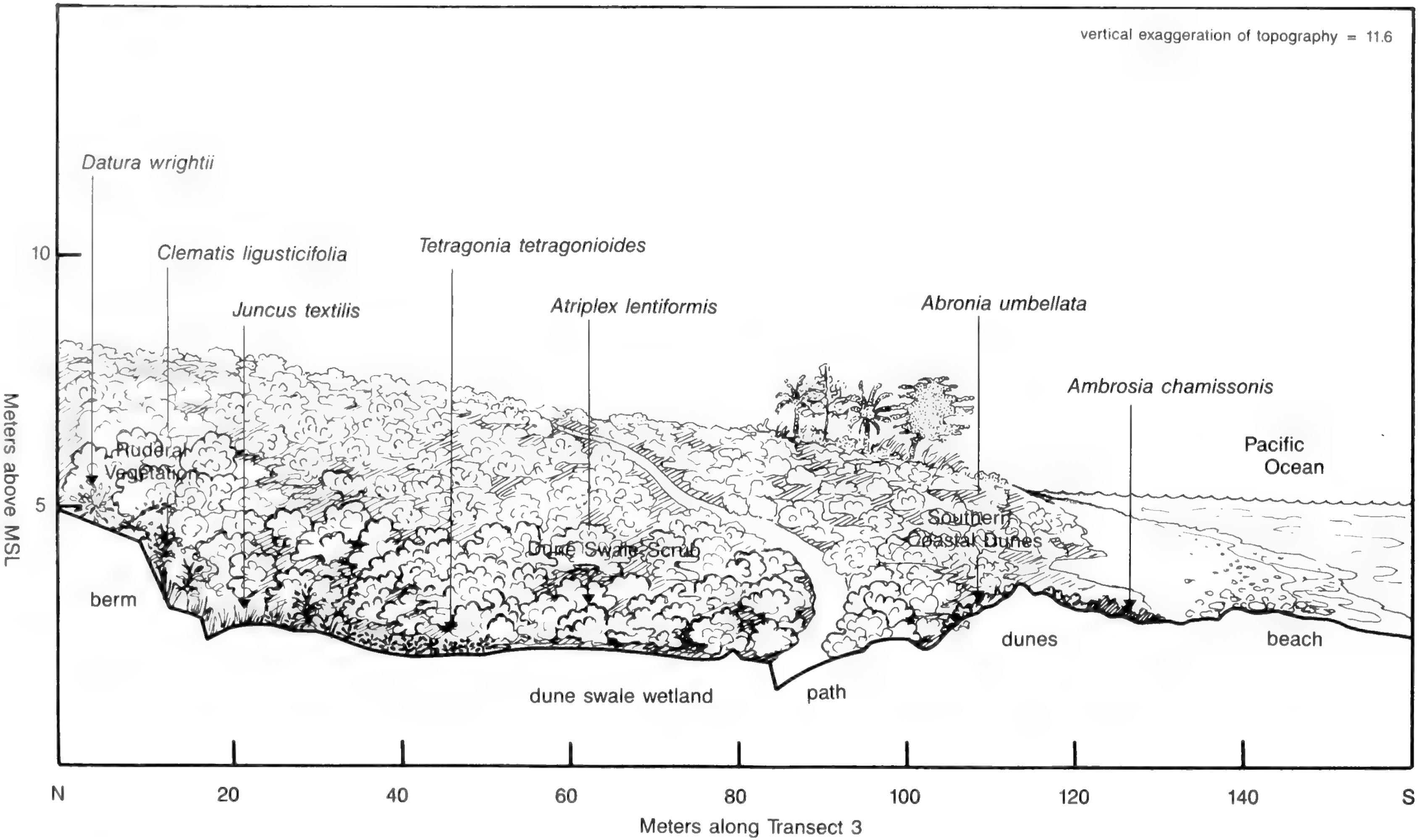

FIG. 14. TOPOGRAPHIC AND VEGETATIONAL PROFILE FOR TRANSECT THREE. View from Emma Wood State Beach eastward toward Seaside Wilderness Park. Artist's rendition illustrates topographic position of dune swale, dune, and beach habitats east of the "Second Mouth." Characteristic plant species also are noted. See Fig. 6 for location of transect and Appendix V for distribution of all species along transect.

FIG. 15. SOUTHERN COASTAL DUNES. Dune vegetation at Emma Wood State Beach is characterized by native species such as Beach Evening Primrose *(Camissonia cheiranthifolia)*, Sand Verbena *(Abronia umbellata)*, and Beach-bur *(Ambrosia chamissonis)* and naturalized species such as Hottentot Fig *(Carpobrotus edulis)* and Sea Rocket *(Cakile maritima)*. "Hobo Jungle" at Seaside Wilderness Park is visible eastward in the background.

FIG. 16. SOUTHERN COASTAL DUNES. Dune vegetation adjacent to a dune swale wetland is characterized by Coast Golden Bush *(Isocoma veneta)* center right and left.

Coastal Sage Scrub. As mapped for this project (Appendix II), Coastal Sage Scrub occurs on road banks and is the result of a revegetation program conducted by CALTRANS and of natural recovery or vegetation succession. Characteristic species include Coyote Brush (*Baccharis pilularis* ssp. *consanguinea*), California Sagebrush (*Artemisia californica*), and California Buckwheat (*Eriogonum fasciculatum*). Natural occurrences of this vegetation are located nearby to the north and west of the study area. Related coastal scrub vegetation known as Coastal Bluff Scrub occurs on coastal bluffs west of the Group Camp and is dominated often by salt-tolerant shrubs such as Brewer's Saltbush (*Atriplex lentiformis* ssp. *breweri*).

Depending on elevation and frequency of disturbance, some forms of riparian and dune swale scrub resemble Coastal Sage Scrub. Three previous vegetation maps for the study area (Boyle 1976, Department of Parks and Recreation 1975, North American School of Conservation and Ecology 1972) all show large areas of flood plain as Coastal Sage Scrub. However, all of this vegetation occurs on flood plain or exposed riverbed habitats. It is subject to seasonal or periodic flooding conditions, can be altered when catastrophic storm flooding occurs, and is often mixed with or now dominated by various native hydrophytes such as Arroyo Willow (*Salix lasiolepis*) and Mule Fat (*Baccharis salicifolia*). Due to the dynamic nature of the habitat, the seasonally elevated water table, and the flood plain or riverbed characteristics of the vegetation, we have grouped all riparian scrub and forest, and dune swale scrub into various wetland and transitional wetland/upland vegetation categories (See: Botanical Resources: Wetlands and Appendix I).

Coastal Bluff Scrub. Although not included in the study area, coastal bluffs occur immediately adjacent to and west of the Ventura River Group Camp at both the Taylor Ranch and western portions of Emma Wood State Beach. Transportation corridors such as U.S. Highway 101, Southern Pacific Railroad, and Main Street, have severely altered the habitat; however, historical herbarium records (e.g., Pollard card file at SBBG) and recent observations by this team reveal a rich flora (e.g., See: Checklist in Appendix IX-B). Low elevation habitats within salt-spray influence support Coastal Bluff Scrub dominated by halophytes such as Brewer's Saltbush and Wooly Sea-blite (*Suaeda taxifolia*). Middle elevations support Coastal Bluff Scrub characterized in part by native cacti, including Coastal

Prickly-pear (*Opuntia littoralis*), Coastal Cholla (*Opuntia prolifera*) and *Opuntia oricola*. Higher elevations support the "Venturan" form of Coastal Sage Scrub (Holland 1986), which is dominated by shrubs such as California Sagebrush, Coyote Brush, California Bush Sunflower (*Encelia californica*), Black Sage (*Salvia mellifera*), Purple Sage (*Salvia leucophylla*), and species of Buckwheat. Rare and/or endangered species of this bluff habitat complex include Aphanisma (*Aphanisma blitoides*) collected by Pollard [1 Jun 1963 (PCF)] from "bulldozed coastal bluffs" about 1.5 miles west of the Ventura River, Oligomeris (*Oligomeris linifolia*) collected by Pollard [1 Jun 1963, 10 Jun 1972 (PCF)] from "foot of maritime bluffs" and "west of Ventura River", and Seaside Calandrinia (*Calandrinia maritima*) collected by Pollard [21 Aug 1965 (PCF)] from the "base of Taylor Ranch maritime bluffs" about one (1) mile west of the Ventura River.

Ruderal Vegetation. Vegetation of artificially disturbed areas occurs in upland and wetland habitats of the study area. Upland ruderal habitats include the mowed grassland area of the Group Camp, railroad berms, and margins of paths and roads. Many upland native and naturalized herbaceous species characterize the habitats, as documented in the Annotated Catalogue of Vascular Plants (Appendix VIII). Examples of common native species are Telegraph Weed (*Heterotheca grandiflora*) and Berlandier's Goosefoot (*Chenopodium berlandieri*). Examples of common naturalized species are Black Mustard (*Brassica nigra*), Sweet Fennel (*Foeniculum vulgare*), Poison Hemlock (*Conium maculatum*), Italian Thistle (*Carduus pycnocephalus*), Fivehook (*Bassia hyssopifolia*), Wild Oats (*Avena* spp.), and Brome grasses (*Bromus* spp.). Many weedy species occur in areas mapped as upland because of the disturbed and well-drained nature of the substrates.

WETLANDS. Wetlands in the vicinity of the Ventura River Delta belong to four major systems: Marine, Estuarine, Riverine, Palustrine (See: Physical Environment: Habitats). We have classified wetlands (Appendix I) according to a modified version of the U.S. Fish and Wildlife Service (USFWS) system (Cowardin et al. 1979). Although nonvegetated wetlands occur in the study area, none are discussed herein. Some vegetation and/or habitats included in this report may not fit the definition or delineation of wetlands by other regulatory or advisory agencies (e.g., U.S. Army Corps of Engineers 1987, U.S. Environmental Protection Agency 1988, and Federal Interagency Committee for Wetland Delineation 1989),

and may not be consistent with other applications of Cowardin et al. (1979).

Marine Wetlands and Deepwater Habitats. Definitions and limits of this system are presented in Physical Environment: Habitats, and in Appendices I and III. A catalogue and checklist of the marine algae collected during this investigation are presented in Appendix VI and VII. In the study area, the Marine System occurs seaward of the Southern Coastal Dunes and the sand spit at the mouth of the Ventura River Estuary, and includes intertidal wetlands and nearshore subtidal deepwater habitats overlying the continental shelf and its shoreline where salinities usually exceed 30 o/oo (ca. 33 o/oo). Marine system habitats in our modified Cowardin et al. (1979) classification system are classified by amount of tidal exposure and by substrate type.

The marine wetland and deepwater habitats in the study area are an extension of the Ventura River Delta. This delta is a product of tectonic and related erosional and depositional processes of the Ventura River and the influence of the Pacific Ocean. The intertidal and subtidal habitats consist of rock and cobble deposited by the Ventura River and sorted by ocean waves, tides, and currents. The cobble material ranges in size from 4-36 inches (10-92 cm) in diameter and is composed primarily of various types of sandstones derived from inland terrestrial formations.

Much of the shoreline along the coast of southern California is covered by sand (Stevenson et al. 1956, California Department of Navigation and Ocean Development 1977, Grigge and Savoy 1985) whereas, hard substrate, which provides a stable material upon which plants and other benthic organisms attach, is relatively rare. Approximately three and a half miles of the 41 miles of coastline in Ventura County (ca. 9%) is comprised of cobble substrate. The 1.3 miles of cobble habitat in the study area represents approximately 37% of the total hard substrate in Ventura County. Boulder fields are an important marine habitat because they provide most of the substrate in the intertidal and subtidal zone in southern California (Dawson 1959, Widdowson 1971, State Lands Commission 1989). Boulders are not immobile, however, and their periodic movement effects the composition of the algal community that may become established upon them. Moreover, small boulders are moved more often by ocean forces than larger ones, and as a result will be differentially colonized by species of algae (Sousa 1979).

High Intertidal: Rocky Shore. This wetland (Figs. 17, 18) occurs on the upper margins of the entire shoreline frontage of the study area [+2.5 to +1.0 feet Mean Lower Low Water (MLLW)]. This area is flooded and exposed by the tides diurnally. The upper tidal areas are dominated by a variety of green algae, including *Enteromorpha* spp., *Ulva* spp., and *Chaetomorpha linum*. There are also areas where *Bryopsis corticulans* is relatively common. A number of red algae such as *Porphyra* spp. and *Grateloupia doryphora* can also be seasonally abundant as an over story.

Mid-Intertidal: Rocky Shore. This wetland occurs in the mid reaches of the entire shoreline fronting the study area (+1.0 to -0.5 feet MLLW). This area is flooded and exposed during most diurnal tidal cycles. The mid-tidal area is dominated by a combination of green and red algae. Dominant species include *Gigartina* spp., *Porphyra* spp., *Ulva* spp., and *Polysiphonia* spp.

Low-Intertidal: Rocky Shore. This wetland occurs on the lower margins of the entire shoreline of the study area (-0.5 to -1.2 feet MLLW). The area is almost continuously flooded, with exposure occurring only during minus tides. The lower tidal area contains the richest composition of species in the intertidal habitats, with representatives from all major algal groups. Dominant algae species include *Gigartina* spp., *Ulva* spp., and *Gracilaria* spp. Additionally, the lower margins are dominated by dense beds of the marine angiosperm Surf Grass (*Phyllospadix torreyi*).

Subtidal: Rocky and Sandy Bottom. This deepwater habitat occurs along the entire near-shore area fronting the study area (-1.2 to -20 feet MLLW). This area is always flooded, although the depth (and amount of sunlight able to reach plants) will vary with the diurnal tides and turbidity. The bottom of the subtidal habitat is a mosaic of boulders and sand. The subtidal area is not dominated by any one species, but rather varies with the substrate and the location in the study area. Species that are locally abundant in sections of the subtidal area are *Egregia menziesii*, *Gigartina* spp., and *P. torreyi*. *Macrocystis pyrifera* (Giant Kelp) is present in only isolated areas within the study area.

Estuarine Wetlands and Deepwater Habitats. Definitions and limits of this system of wetlands and deepwater habitats are presented in Physical Environment:

FIG. 17. MARINE WETLAND. View westward along coastline of Emma Wood State Beach and delta of the Ventura River. Beach Sand (upper right) is contigious to dunes beyond the photograph. Intertidal cobble wetlands support many species of algae (e.g., *Ulva* spp. shown here in the upper zone) and the marine angiosperm *Phyllospadix torreyi*, which colonizes the lower zone and subtidal deepwater habitats.

FIG 18. MARINE WETLAND. View northwestward across intertidal cobble field. Vegetated dunes (upper center) border the eastern portion of Emma Wood State Beach. Upper zone of intertidal cobble wetlands shown here are dominated by *Ulva* spp., *Enteromorpha* spp., *Chaetomorpha linum*, and *Porphyra* spp.

Habitats, and in Appendix I and Cowardin et al. (1979). Profiles along transects sampled in the study area (Figs. 19, 20) display the relationship between topography and estuarine wetlands. A transect laterally (E-W) through the Ventura River Estuary (Fig. 19) illustrates channels, bars and the occurrence of various estuarine species. In this example, seasonally exposed and permanently flooded habitats are evident. A transect longitudinally (N-S) through the Second Mouth Estuary also illustrates seasonally exposed and permanently flooded habitats dominated by species differing from those in the previous transect. See Appendix V for additional transects and species distributions sampled in various habitats during this study.

Estuarine Aquatic Bed Deepwater Habitats. Aquatic bed vegetation in the study area occurs as a submerged, rooted vascular type and a floating type. The rooted vascular type can grow in subtidal habitats and intertidal flats or channels. The mouth of the Ventura River Estuary is closed for long periods by a sandbar, which results in the formation of a nontidal lagoon. Permanently flooded habitats are not exposed at low tide when the mouth is open to the ocean. Apparently most of the habitat is not vegetated; however, we have observed fragments of Spiral Ditchgrass (*Ruppia cirrhosa*) floating in the estuary. It was probably uprooted by birds, because it is an important source of food for water fowl (Sculthorpe 1967). This rooted aquatic plant is rarely observed in coastal habitats, but may be characteristic of brackish estuaries in central (e.g., San Antonio Creek Estuary in northern Santa Barbara County) and southern California. It probably grows submerged in subtidal habitats in the Ventura River Estuary, although we have not observed it under these conditions. It does grow in permanently flooded estuarine habitats at the Second Mouth Estuary, where salinity conditions generally range from 10-16 o/oo. Ditchgrass (*Ruppia maritima*) is more common in coastal habitats of southern California than is Spiral Ditchgrass, and we have observed Ditchgrass in saline, hypersaline (salinity greater than seawater), or euryhaline (fluctuating salinity) conditions such as those at Goleta Slough (Ferren and Rindlaub 1983), Carpinteria Salt Marsh (Ferren 1985), and Devereux Slough (Ferren et al. 1987). In the vicinity of the study area it has been collected in "brackish pools" near Pierpont Inn [*Pollard* s.n. 8 Jun 1961 (SBBG)]. We have not found both species growing in the same estuary, although a report of *R. maritima* from the mouth of the Ventura River [*Pollard* s.n. 27 Oct 1945 (PCF)] might suggest that either this species grew here under more saline conditions or the

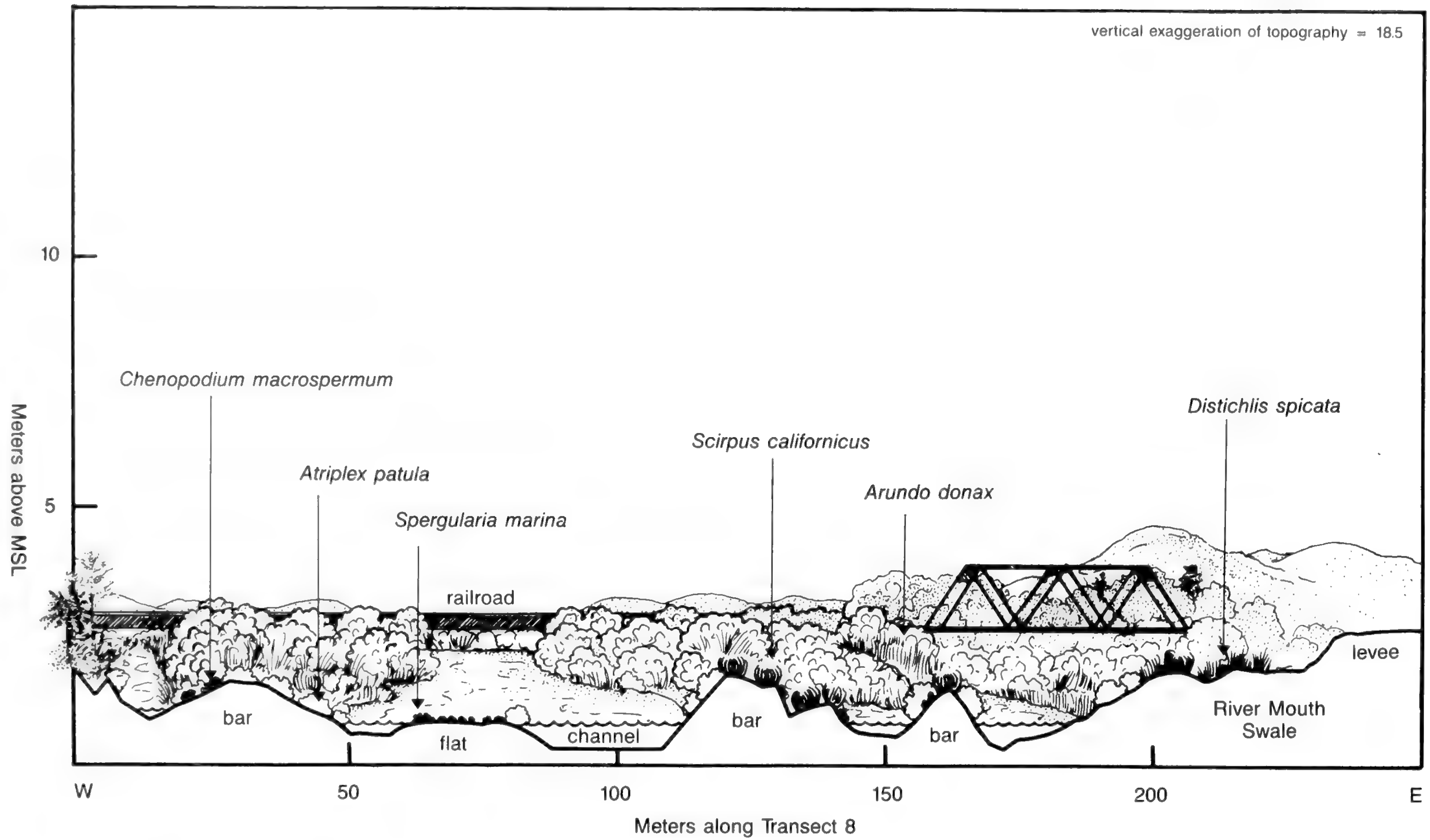

FIG. 19. TOPOGRAPHIC AND VEGETATIONAL PROFILE FOR TRANSECT EIGHT. View from Seaside Wilderness Park northward up the Ventura River Estuary. Artist's rendition illustrates topographic position of channels, bars, and flats in the estuary. Estuarine Emergent Wetlands occur along the transect. Palustrine Forested Wetlands dominated by Arroyo Willow occur in the background. See Fig. 6 for location of transect and Appendix V for distribution of all species along transect.

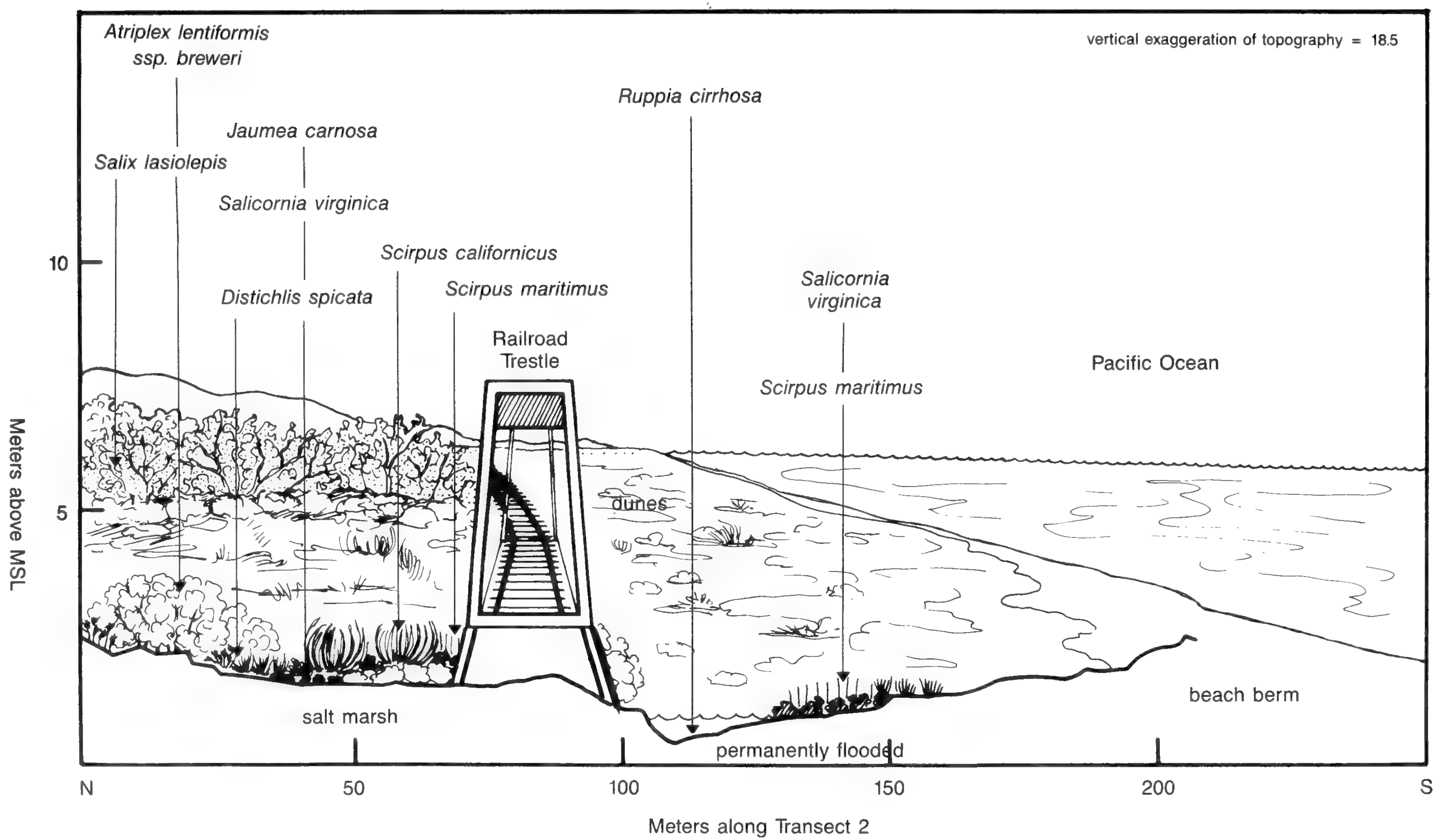

FIG. 20. TOPOGRAPHIC AND VEGETATIONAL PROFILE FOR TRANSECT TWO. View from "Second Mouth" of Ventura River at Emma Wood State Beach, eastward along South Pacific Railroad toward Seaside Wilderness Park. Artist's rendition illustrates position of salt marsh vegetation, permanently flooded basin, Palustrine Forested Wetland (background), dunes, and beach berm. See Fig. 6 for location of transect and Appendix V for distribution of all species along transect.

specimen was misidentified because it has not been observed by this research team.

Floating aquatic bed vegetation also occurs at the Ventura River Estuary. Under lagoonal conditions when the surface salinity approximates 0.5-2 o/oo, Duckweed (*Lemna minor*) and Duckweed Fern (*Azolla filiculoides*) occur in floating masses on the margins of the lagoon. Masses of the floating alga *Enteromorpha intestinalis* often occurs with them. Duckweed and Duckweed Fern are characteristic of freshwater habitats, such as in the channels of the Ventura River. They are probably washed down the river into the estuary, where they persist under the slightly brackish (oligohaline) or freshwater conditions.

Estuarine Nonpersistent Emergent Wetlands. Nonpersistent emergent vegetation generally lacks aboveground persistent parts and is frequently composed of annual plants that colonize seasonally or regularly exposed habitats. In the Ventura River Estuary, nonpersistent emergent vegetation occurs in intertidal wetlands consisting of exposed lagoonal bars, flats, and shallow channel beds (Figs. 21, 22). Vegetated wetlands of this type are uncommon in southern California and may be characteristic of or even restricted to lagoonal estuaries that occur at the mouths of rivers. Because brackish rather than saline or hypersaline conditions prevail and because habitats are often exposed for weeks, annual plants can colonize habitats that do not exist in estuaries with a greater marine influence. In the Ventura River Estuary, Nonpersistent Emergent Wetland is characterized by the native species Spear-leaved Saltbush (*Atriplex patula*), Coast Goosefoot (*Chenopodium macrospermum*), and Salt Marsh Sand Spurrey (*Spergularia marina*). Introduced species include Brass Buttons (*Cotula coronopifolia*) and Rabbitfoot Grass (*Polypogon monspeliensis*).

The Estuarine Nonpersistent Emergent Wetlands at the Ventura River Estuary are quite different from those of estuaries in southern California with euryhaline marshes. Annual plants in the latter type grow when precipitation during the winter leaches salts from upper marsh and transitional wetlands on the margins of deltas (Ferren 1985, Ferren et al. 1987). These annuals die when a return to drought conditions in spring produces hypersaline soils. Salt Marsh Sand Spurrey is apparently the only dominant species that occurs in both hypersaline and brackish nonpersistent emergent wetlands.

FIG. 21. ESTUARINE NONPERSISTENT EMERGENT WETLAND. View northwestward across the upper Ventura River Estuary towards the Coast Ranges. During spring and summer low flow conditions, and when the mouth of the estuary remains open, annual plant species such as Salt Marsh Sand Spurrey *(Spergularia marina)*, Spear-leaved Saltbush *(Atriplex patula)*, and Brass-buttons *(Cotula coronopifolia)* colonize the exposed bars and flats. Palustrine Forested Wetland occurs on the floodplain adjacent to the estuary.

FIG 22. ESTUARINE NONPERSISTENT EMERGENT WETLAND. View southward from the lower Ventura River Estuary to the Pacific Ocean. Exposed bars and flats are colonized by annual plant species such as Coast Goosefoot *(Chenopodium macrospermum)*, Salt Marsh Sand Spurrey *(Spergularia marina)*, and Spear-leaved Saltbush *(Atriplex patula)*.

Estuarine Persistent Emergent Wetlands. Persistent emergent vegetation is dominated by perennial herbaceous species that usually have aboveground parts that persist from year to year (e.g., suffrutescent and succulent perennials) or that produce enough biomass that the standing dead, aboveground parts affect the nature of the habitats. Several examples of Estuarine Persistent Emergent Wetland occur in the study area (Appendices I, II). In the Ventura River Estuary, the dominant example is a type of "brackish marsh" that occurs on the margins of the estuary near highwater of flooded lagoonal conditions (Fig. 19). The characteristic species are Narrowleaf Cattail (*Typha domingensis*) and California Bulrush (*Scirpus californicus*). Similar vegetation occurs in and on the margins of the permanently flooded basin of the Second Mouth Estuary of the Ventura River. In this habitat, Alkali or Prairie Bulrush (*Scirpus maritimus*) and California Bulrush are dominant (Fig. 23). Also associated with the Second Mouth Estuary are seasonally flooded saline soils dominated by "salt marsh" vegetation consisting of succulent and suffrutescent perennials (Figs. 20, 24). Characteristic species include Alkali Heath (*Frankenia salina*), Jaumea (*Jaumea carnosa*), Pickleweed (*Salicornia virginica*), and Coastal Saltgrass (*Distichlis spicata*). Open, desiccated substrates are often colonized by the naturalized biennial Marsh Sagebrush (*Artemisia biennis*). Because Estuarine Emergent Wetlands associated with the Second Mouth Estuary are infrequently flooded by either marine or riverine water, but rather flood largely from precipitation or high water table conditions, this group of wetlands could be classified in the Palustrine System (See: Appendix I and Botanical Resources - Palustrine Wetlands). However, due to the dynamic nature of the Ventura River Mouth and the likelihood that drought and conditions of desiccation will change, we have placed these wetlands in the Estuarine System. Impacts to this wetland include access roads through habitats, additional filling of wetlands (should the remaining railroad trestle be replaced with a berm and culvert), fragmentation, reduced flooding, and encroachment of the beach berm and sand dunes.

Estuarine Scrub/Shrub Wetlands. Scrub/shrub wetland is characterized by low-growing, woody species that may be shrubs or juvenile/stunted trees. In the study area, Estuarine Scrub/Shrub Wetlands occur in two forms, but is poorly developed and is largely transitional to Palustrine Scrub/Shrub Wetlands. On the margins of the Ventura River Estuary, it occurs near the limit of high water during

FIG. 23. ESTUARINE PERSISTENT EMERGENT WETLAND. View near Second Mouth Estuary of river northward from cobble beach toward U.S. Highway 101. This salt marsh type of estuarine wetland (center) is dominated by Pickleweed *(Salicornia virginica)*. Estuarine Scrub/Shrub Wetland (north of path) is dominated by Brewer's Saltbush *(Atriplex lentiformis ssp. breweri)*.

FIG 24. ESTUARINE PERSISTENT EMERGENT WETLAND. View at Second Mouth Estuary of river southwestward from bridge of Southern Pacific Railroad toward the Pacific Ocean. This brackish water type of estuarine wetland is dominated by Prairie Bulrush *(Scirpus maritimus)* and California Tule *(Scirpus californicus)* on the margins of the flooded basin. Exposed margins of the estuary are characterized by typical salt marsh species such as Pickleweed *(Salicornia virginica)*, Alkali Heath *(Frankenia salina)*, and Jaumea *(Jaumea carnosa)*. The permanently flooded deepwater habitat is dominated by the submerged aquatic Spiral Ditch-grass *(Ruppia cirrhosa)*.

lagoonal conditions and is characterized by narrow, interrupted bands of Mule Fat, Arroyo Willow, and Sandbar Willow (*Salix sessilifolia*). It usually occurs adjacent to Estuarine Emergent Wetland and Palustrine Forested Wetland. In the vicinity of the Second Mouth Estuary, Estuarine Scrub/Shrub Wetland occurs north and south of the railroad on the margins of the "salt marsh" form of Estuarine Persistent Emergent Wetland (Fig. 23). Brewer's Saltbush is the dominant shrub of the saline soils and is generally mixed with herbaceous species such as Pickleweed and Western Goldenrod (*Euthamia occidentalis*). This form of Estuarine Scrub/Shrub Wetland is transitional to Palustrine Scrub/Shrub Wetland in the study area and is largely distinguished from the latter by proximity to the estuary and association with salt marsh species. Other woody species that are minor elements of the vegetation include Arroyo Willow, Mule Fat, and the invasive exotic Salt Cedar (*Tamarix ramosissima*).

Riverine Wetlands and Deepwater Habitats. Definitions and limits of this system of wetlands and deepwater habitats are presented in Physical Environment: Habitats, and in Appendix I and Cowardin et al. (1979). In the study area, this system is represented by a limited amount of riverine wetland only on the Hubbard Property and in the small area immediately above the Main Street Bridge included in the study area. The Ventura River Estuary, which occurs downriver from the riverine system, occupies most of the channels (See: Appendix II-Map of the Vegetation) within the study area. Extensive riverine wetlands occur beyond the study area, upriver from Main Street Bridge. Riverine wetlands are characterized by nonpersistent vegetation that reflects the nature of the environment (i.e., flowing water and disturbance as a result of periodic flooding).

Riverine Aquatic Bed Wetlands. Aquatic bed vegetation occurs as a submerged, rooted vascular type and a floating type, both of which occur in the Ventura River. The shallow, perennial channel of the river provides potential habitat for a number of rooted vascular species; however, little evidence exists of its actual extent. Species typical of this vegetation have rarely been collected or observed directly in the study area; however, Leafy Pondweed (*Potamogeton foliosus*), Fennel Pondweed (*Potamogeton pectinatus*), and Horned Pondweed (*Zannichellia palustris*) have been collected upstream from the study area (See: Appendix VIII, and Smith 1976). The apparent lack of submerged rooted vascular species may be related to reduced water quality in the low-flow river channel.

Increased turbidity and altered water chemistry, resulting from various effluents that are discharged through a series of storm drains and out falls into the river, have decreased water quality in both the river and estuary. These effects have been accentuated because diversion projects have reduced river flows, and thus have decreased the river's ability to ameliorate potential impacts from pollution. Other impacts to the submerged flora come from extensive stands of naturalized emergent species such as Water Primrose (*Ludwigia uruguayensis*). This invasive exotic plant can clog shallow river channels resulting in a reduction of light in the aquatic environment and potentially preventing the growth of native submerged species.

Floating aquatic bed vegetation also occurs in riverine wetlands of the Ventura River. In the study area, it is characterized by generally isolated masses of Duckweed (*Lemna minor*) and Duckweed Fern (*Azolla filiculoides*). Mixed populations of these species occur on channel margins, in backwater pools, and seasonally flooded/desiccated beds and flats.

Riverine Emergent Wetlands. Vegetation of Riverine Emergent Wetland in the Ventura River is characterized by different associations dependent upon elevation and water regime. Seasonally exposed margins of the river channel are colonized by various annuals including mostly naturalized species such as Common Horseweed (*Conyza canadensis*) and Cudweed Everlasting (*Gnaphalium luteo-album*). When few plants occur and the habitat is largely exposed substrate, the wetland can be classified as Riverine Unconsolidated Shore Wetland. At lower elevations (Fig. 25) on the channel slope, in or immediately adjacent to permanently flooded areas, and on exposed or shallowly flooded bars, Riverine Emergent Wetland is often composed of a dense mixture of native and naturalized species. Depending on the density of persistent species, the vegetation can be transitional to Palustrine Emergent Wetland, particularly if cattails and bulrushes occur. Characteristic native species in the Riverine Emergent Wetland include Dotted Water Smartweed (*Persicaria punctata*), Northern Willow-Herb (*Epilobium ciliatum*), and Water-parsnip (*Berula erecta*). Common naturalized species include Brass Buttons, Water Primrose, Water-cress (*Rorippa nasturtium-aquaticum*), and Water Speedwell (*Veronica anagallis-aquatica*) (Fig. 26).

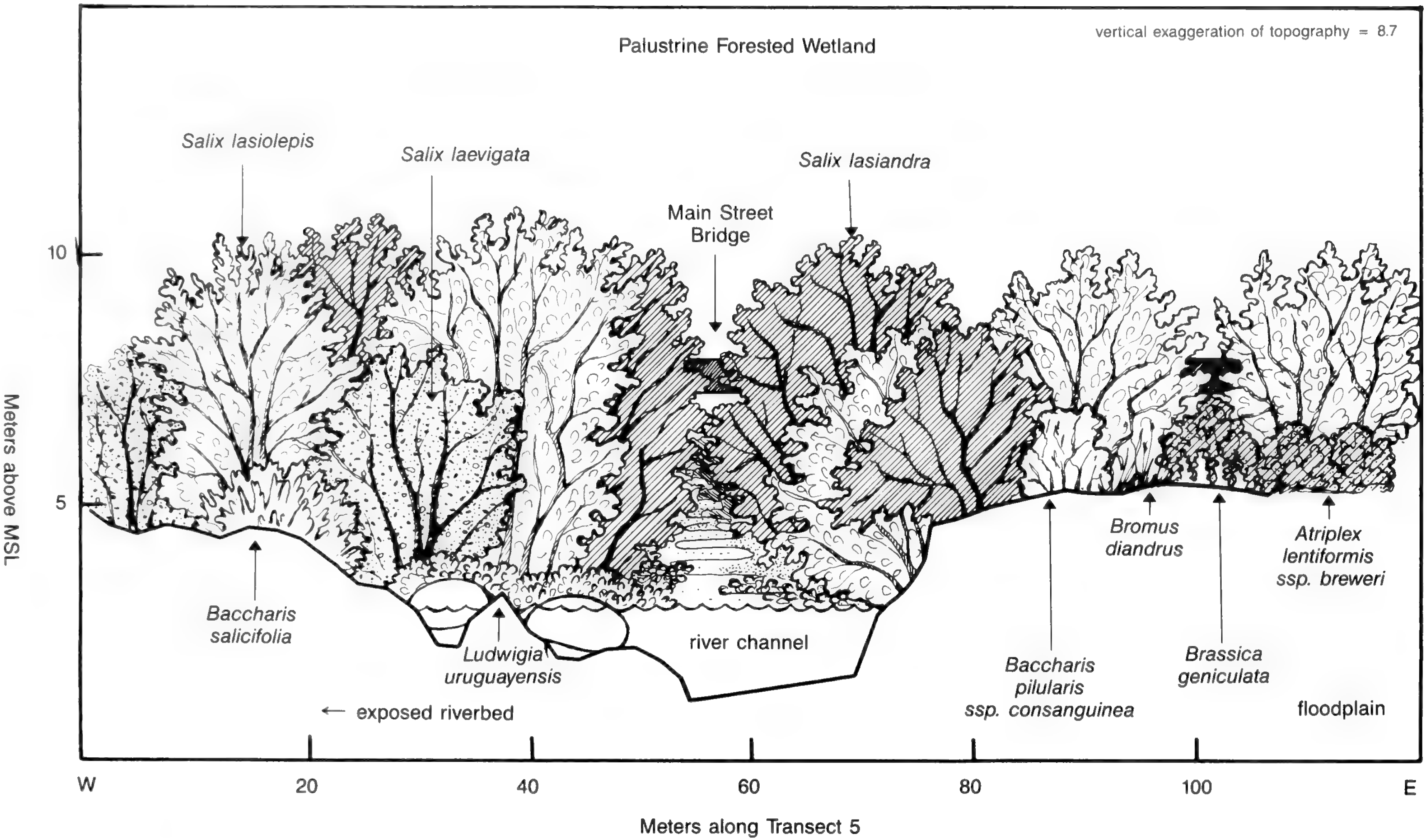

FIG. 25. TOPOGRAPHIC AND VEGETATIONAL PROFILE FOR TRANSECT FIVE. View on the Hubbard Property northward up the perennial channel of the Ventura River. Artist's rendition illustrates topographic position of exposed bed, bar, channel, and floodplain. Riverine Emergent Wetland occurs along the perennial channel and Palustrine Forested Wetland occurs in the background. See Fig. 6 for location of transect and Appendix V for distribution of all species along transect.

FIG. 26. RIVERINE EMERGENT WETLAND. View northward up the perennial river channel at riffles that mark the transition between the estuary (downstream) and the river (upstream). Nonpersistent Emergent Wetland is dominated by Water Primrose *(Ludwigia uruguayensis)* right and left of channel. This species is an invasive exotic that often characterizes the riverine wetlands but does not occur along the estuary where brackish water apparently limits its growth. Palustrine Forested Wetland (river channel margin type) occurs in the background and is characterized by White Alder *(Alnus rhombifolia)*, Red Willow *(Salix laevigata)*, *Yellow Willow (S. lasiandra)*, and Arroyo Willow *(S. lasiolepis)*.

Palustrine Wetlands. Definitions and limits of this system of wetlands are presented in Physical Environment - Habitats, and in Appendix I and Cowardin et al. (1979). In the study area, these wetlands include "freshwater marshes", "dune swales", "riparian scrub", and "riparian woodlands and forests." Transects through these wetlands, with topographic and species distribution information, are presented in Appendix V.

Palustrine Persistent Emergent Wetlands. All emergent wetlands of the Palustrine System in the study area are classified as the persistent type. Three examples (Appendices I, II) reflect differences in habitat characteristics such as salinity, substrate, and water regime. The riverbed and channel margin type is seasonally or permanently flooded by freshwater and is dominated by cattails such as Broadleaf Cattail (*Typha latifolia*), bulrushes such as California Bulrush (*Scirpus californicus*), and rushes such as Iris-leaved Rush (*Juncus xiphioides*). An invasive exotic species, Giant Reed (*Arundo donax*), also can occur in this vegetation. This "freshwater marsh" type of Palustrine Emergent Wetland generally occurs upriver from the study area and adjacent to Palustrine Scrub/Shrub and/or Forested Wetlands and Riverine Emergent Wetlands, and is similar to the Estuarine Persistent Emergent Wetland (i.e., "brackish marsh") that occurs downriver on the margins of the Ventura River Estuary. Depending on the amount of disturbance created during storm flows of the Ventura River, this form of Palustrine Emergent Wetland is occasionally destroyed and temporarily converted to habitat for Riverine Emergent Wetland.

A second type of Palustrine Emergent Wetland occurs in Emma Wood State Beach between dunes and the railroad (Fig. 14) and is a remnant of a "dune swale wetland" that has saline, clay soils and is seasonally saturated or flooded only by water from rain. Historically, however, it apparently was connected to the estuary of the Second Mouth Estuary and has soils derived from estuarine substrates. In soils that are more saline than other dune swale sites, native halophytes such as Pickleweed, Alkali Heath, and Alkali Rye (*Elymus triticoides*) occur. At other apparently less saline sites, Basket Rush (*Juncus textilis*) and Yerba Mansa (*Anemopsis californica*) occur in seasonally saturated or moist sites, and Narrowleaf Cattail and California Bulrush occur in a seasonally flooded low area. Desiccated open substrates are colonized by nonpersistent species such as the native Marsh Horseweed (*Conyza coulteri*) and naturalized Marsh Sagebrush

and Hoary Cress (*Cardaria draba*). Disturbances such as trails, fire, and landward migrations of dunes have impacted the site, causing reduction or conversion of habitat. Several years of drought and subsequently drier soils, have favored shrubs and upland herbaceous species; and thus native woody plants such as Brewer's Saltbush, Coyote Brush, and Poison Oak (*Toxicodendron diversilobum*), plus the invasive exotic New Zealand Spinach (*Tetragonia tetragonioides*) and the grass Giant Rye (*Elymus condensatus*) have invaded the "Dune Swale Wetland."

A third type of Palustrine Emergent Wetland occurs in Seaside Wilderness Park on the eastern margin of the Ventura River Estuary at about 6 feet (1.8 meters) above MSL. The habitat has hydric soils, is often saturated, and occasionally ponds with rain water or floods in low spots when the lagoonal phase of the Ventura River Estuary is at maximum height. This "river mouth swale wetland" supports many estuarine emergent species such as Jaumea and Pickleweed and other coastal hydrophytes that often grow in saline soils, such as Alkali Rye and Salt Marsh Baccharis (*Baccharis douglasii*). In the study area, species apparently unique to the site include Spiny Rush (*Juncus acutus* var. *sphaerocarpus*) and Marsh Cinquefoil (*Potentilla anserina*). The vegetation is adjacent and transitional to Estuarine Emergent Wetlands and Palustrine Scrub/Shrub Wetlands and is threatened by an invasive exotic plant, Kikuyu Grass (*Pennisetum clandestinum*).

Palustrine Scrub/Shrub Wetlands. Broad-leaved deciduous and evergreen woody species characterize this vegetation; however, many types occur in the study area and they reflect the various water and salinity regimes, disturbance history, and age of the habitat in this dynamic environment at the Ventura River Mouth. Many types belong to the general group of "Southern Riparian Scrub" described by Holland (1986). Some are transitional to upland vegetation such as "Coastal Sage Scrub" and "Introduced Annual Grassland". Others reflect the saline nature of soils and can be described as "Dune Swale Scrub" and "Coastal Saltbush Scrub". We have grouped all of these into Palustrine Scrub/Shrub Wetlands and have identified and mapped seven types in the study area (See: Appendix II-Map of the Vegetation).

Those scrub types most typical of riparian scrub vegetation occur in or adjacent to the river channel. Exposed Riverbed and Bar Scrub (Fig. 27) is

subjected to occasional or even seasonal flooding, and thus has more frequent disturbance than many types. Its density depends on the severity and frequency of flooding. It is characterized by scattered shrubs of Mule Fat, immature Arroyo Willow, and Scale-Broom (*Lepidospartum squamatum*), which is restricted to and typical of riparian scrub influenced by flowing water on an irregular basis. Many native and naturalized, low-growing, woody and herbaceous species more typical of upland habitats also colonize the well-drained "river wash." It is perhaps the most botanically rich habitat and wetland type in the study area. Without repeated flooding and disturbance, this vegetation will become dominated by Arroyo Willow in the form of Riverbed and Dune Swale Scrub and eventually to Palustrine Forested Wetland. A third form of typical riparian scrub occurs along the exposed channel margins and bars immediately adjacent to permanently flooded habitat. "River Channel Margin Scrub" is characterized by the colonial shrub Sandbar Willow (*Salix sessilifolia*) and may include Mule Fat and immature Arroyo Willow.

Broad flood plain habitats occur adjacent to the river channel and support a mosaic of several forms of coastal scrub that we classify as Palustrine Scrub/Shrub Wetlands. Elevations occur between approximately 7-17 feet (2.1-5.2 meters) above Mean Sea Level and the soils are sandy loams (See: Physical Environment-Soils). Higher elevations support vegetation transitional to Coastal Sage Scrub. This "Flood Plain Mixed Scrub" includes the hydrophytes Mule Fat and Arroyo Willow, facultative species such as Brewer's Saltbush and Coyote Brush, and largely upland shrubs such as California Sagebrush (*Artemisia californica*) and Hoary Ceanothus (*Ceanothus oliganthus*). This vegetation occurs on elevated sandbars deposited during flood conditions and is vulnerable to additional flooding, erosion, and conversion to other wetland habitats. This mixed scrub also can be scattered among open areas dominated by many naturalized herbaceous and annual grassland species. "Flood Plain Mixed Scrub and Grassland" is characterized by naturalized annual grasses including Wild Oat (*Avena* spp.), Ripgut Grass (*Bromus diandrus*), and Soft Chess (*Bromus hordeaceus*). Some of this mixed vegetation occurs at sites of abandoned agriculture and many reflect artificial disturbance rather than the natural attributes of the habitat.

Elsewhere on the flood plain, saline clay soils at lower elevations such as those adjacent to estuarine wetlands at the Second Mouth Estuary support dense stands of Brewer's Saltbush to form "Coastal Saltbush Scrubs" (Fig. 28). Another

FIG. 27. PALUSTRINE SCRUB/SHRUB WETLAND. View northeastward across the western floodplain of the Ventura River. This type of riparian scrub (Salt Bush Scrub) is transitional between wetland and upland types and is dominated by Brewer's Saltbush *(Atriplex lentiformis ssp. breweri*, foreground). Palustrine Forested Wetland (left and right center) is dominated by Arroyo Willow *(Salix lasiolepis)*. Giant Reed *(Arundo donax)* is an invasive exotic plant that is common (center) in the floodplain vegetation.

FIG 28. PALUSTRINE SCRUB/SHRUB WETLAND. View northward from the Hubbard Property toward Main Street and the coastal foothills of the Transverse Range. This exposed riverbed type of riparian scrub is characterized by Scale-Broom *(Lepidospartum squamatum)*, Mule Fat *(Baccharis salicifolia)*, Arroyo Willow *(Salix lasiolepis)* and various herbaceous species.

dense scrub occurs in abandoned temporary river channels that were formed in the flood plain during rare catastrophic flooding events when the river also flowed through its Second Mouth Estuary. This "Temporary River Channel Scrub" is characterized by species from all other categories of Palustrine Scrub/Shrub Wetland in the study area, including Arroyo Willow, Sandbar Willow, Mule Fat, Coyote Brush, Coast Goldenbush, Scale-Broom, and Brewer's Saltbush.

The remaining Palustrine Scrub/Shrub Wetland in the study area occurs south of the Southern Pacific Railroad and landward from marine wetlands. The saline clay and sandy soils of dune swales are dominated by "Dune Swale and Saltbush Scrub" eastward of the estuary at the Second Mouth Estuary. Elevations here range from 4-7 feet (1.2-2.1 meters) above MSL and the vegetation is adjacent to or mixed with Palustrine Emergent Wetland. Characteristic species include Brewer's Saltbush and Coyote Brush. The saline clay and sandy soils westward of the Second Mouth Estuary occur in a beach swale behind a cobble berm at elevations 7-9 feet (2.1-2.7 meters).

This site was used for agriculture until the mid-1940's, and thus the present vegetation may still reflect disturbance as well as natural conditions. Dominant shrubs include Coast Goldenbush and stunted plants of Brewer's Saltbush, Coyote Brush and Arroyo Willow. Common herbaceous species include California Saltbush and the invasive exotic New Zealand Spinach.

Although we have classified the wetland and transitional scrub vegetation into many types that reflect variations in topography, soil, hydrology, disturbance, and characteristic species, all types are generally typical of the dynamic environment of a river mouth in the region, where riverine, estuarine, marine and palustrine wetland interface in a complex association of habitats that can be affected repeatedly by seasonal as well as catastrophic changes. A similar situation exists for riparian woodlands and forests.

Palustrine Forested Wetlands. As with Palustrine Scrub/Shrub Wetlands, many types of Palustrine Forested Wetland occur in the study area (See: Appendices I, II). They are all broad-leaved deciduous types typical of riparian woodlands and forests of the region, and occur in habitats with different topography, water regimes, and disturbance histories. "River Channel Margin

Forest" is the most aquatic of the types and occurs as a narrow band of trees along the seasonally flooded margins of the permanently flooded channel (Fig. 25). It is one of the richest although limited forested wetland types in the region and often includes a mixed stand of White Alder (*Alnus rhombifolia*), Arroyo Willow, Red Willow (*Salix laevigata*), and Yellow Willow (*Salix lasiandra*). Another forested wetland is associated with exposed channels and beds at about 7-9 feet (2.1-2.7 meters) above MSL and is dominated by Arroyo Willow (Figs. 29, 30). At some sites, this "Exposed Riverbed Forest" forms monospecific dense stands of small trees; at other sites it occurs as open woodland associated with various types of Palustrine Scrub/Shrub Wetland. These types are also known as Southern Arroyo Willow Riparian Woodland and Forest (Holland 1986).

Other forested wetlands occur on sandy loam, flood plain soils adjacent to the river channel and exposed beds at about 9-17 feet (2.7-5.2 meters) above MSL. These more mature forests are rarely flooded during catastrophic storm runoff. Some sites are dominated only by Arroyo Willow ("Flood Plain Willow Forest"), whereas other sites include a mixture of Arroyo Willow and Black Cottonwood (*Populus trichocarpa*) and occasional small trees of California Walnut (*Juglans californica*), Blue Elderberry (*Sambucus mexicana*), and the naturalized Castor Bean (*Ricinus communis*). These rich forests support several lianas including Poison Oak, Virgin's Bower (*Clematis ligusticifolia*), California Blackberry (*Rubus ursinus*), and Wild Cucumber (*Marah fabaceus*). Native shrubs of the association include California Wild Rose (*Rosa californica*) and Toyon (*Heteromeles arbutifolia*). Native herbaceous species are represented by California Hedge Nettle (*Stachys bullata*), Few-Seeded Bittercress (*Cardamine oligosperma*), Common Eucrypta (*Eucrypta chrysanthemifolia*), and California Figwort (*Scrophularia californica*). This forested wetland community includes both Southern Cottonwood Riparian Forest and Southern Arroyo Willow Riparian Forest (Holland 1986).

Ruderal Habitats. Ruderal or artificially disturbed habitats are often difficult to attribute to wetlands or uplands when they occur on flood plains. Although many habitats and plant associations in the study area reflect repeated episodes of natural disturbance, some areas have received periods of artificial disturbance that resulted in colonization by weedy species or invasive exotic species or in the persistence of cultivated species (See: Appendix II-Map of the

FIG. 29. PALUSTRINE FORESTED WETLAND. View southward from Main Street Bridge toward U.S. Highway 101 (elevated above the floodplain and river, across top of photograph). The river channel margin type of forested wetland shown here is characterized by White Alder *(Alnus rhombifolia)*, Arroyo Willow *(Salix lasiolepis)*, Red Willow *(Salix laevigata)*, and Yellow Willow *(Salix lasiandra)*.

FIG 30. PALUSTRINE FORESTED WETLAND. View eastward across the Ventura River Estuary. The floodplain type of riparian forest is dominated by Arroyo Willow *(Salix lasiolepis)*. Estuarine Persistent Emergent Wetland, characterized by Narrowleaf Cattail *(Typha domingensis)*, occurs along the flooded margin of the estuary and adjacent to the forested wetland. High water conditions in the estuary indicate the mouth is closed by a sandbar causing water to accumulate in the lagoon.

Vegetation). For example, paths and roads through the forested wetlands are often colonized by Castor Bean; areas of fill are colonized by Black Mustard; and disturbed, desiccated saline soils are often dominated by New Zealand Spinach. Mowed and planted areas at the campground at the Ventura River Group Camp are colonized by many weedy native and naturalized species. Perhaps the most disturbed area beyond the campground is the western portion of Seaside Wilderness Park. Persistent Monterey Cypress (*Cupressus macrocarpa*) and Date Palms (*Phoenix dactylifera*) that were planted here, in addition to naturalized shrubs such as Myoporum (*Myoporum laetum*), plus Hottentot Fig (*Carpobrotus edulis*) and extensive areas of New Zealand Spinach, are characteristic of the site. The natural habitats are no longer evident and the degraded area continues as a mixture of native, persistent cultivated, and naturalized trees, shrubs and herbaceous species.

Area and Percent Cover of Vegetation and Habitats

Analysis of the vegetation map (Appendix II) has yielded the area and percent cover of nonmarine vegetation and habitats (Table 1) and a ranking of categories from largest to smallest unit (Table 2). These results provide a useful demonstration of the amount of different types of wetland (as per our classification in Appendix I) and of the common versus rare vegetation or habitats. This information can be useful during the development of management priorities such as the protection of particularly rare resources. Some observations regarding the analysis include: 1) palustrine wetlands cover more area (>55 acres = 37%) than other wetland types, and within this category scrub/shrub wetlands are the most abundant type (>34 acres = 23%); 2) subtidal deepwater habitats are the most abundant estuarine category (11 acres = 7%) based on the aerial photograph used, but together the intertidal nonvegetated and nonpersistent vegetated categories also are common (7 acres = 5%); 3) the rarest unit of vegetation is estuarine aquatic bed (.028 acres = .02%); 4) ruderal habitats are the second largest group of categories in the study area (>30 acres = 20%). Many other comparisons are possible, but results should be considered relative rather than absolute, because of changes in vegetation, timing of photograph, and potential error in areal estimations.

Quantitative Vegetation Analysis

Nine transects were surveyed for topography and plant distributions and 49 plots, generally located on those transects, were sampled for species cover. Graphic representations of the transect data are presented in Appendix V and an artist's rendition of the vegetation structure along four of the transects is presented in Figures 14, 19, 20 and 25. We have used transect data to document the current conditions of botanical resources at selected locations; we have used plot data to provide an alternate classification of vegetation and an analysis of the relationship of vegetation to topography and flooding. Quantification of vegetation along transects and in plots can be used in future sampling periods to determine changes in topography, vegetation, and species distribution.

<u>**Presentation of Graphical Data Analysis**</u>. Transects 1 and 4 extended roughly north to south, and Transects 5-9 extended west to east (See: Fig. 6 in Methods). The transects were characterized by very different vegetation communities and species composition (See: Transect profiles in Appendix V, Figs. V-1-18). Transect 1 (with Plots 1-5) was situated over a relatively flat area extending from the beach berm to the railroad embankment, and was composed of coastal scrub and salt marsh species (Appendix V, Figs. V-1, 2). The Second Mouth Estuary of the Ventura River was located in the middle of Transect 2 (with Plots 6-13), which extended from beach vegetation through salt marsh species into a coastal scrub (Appendix V, Figs. V-3, 4). Transect 3 (with Plots 14-17) had end points at the beach and railroad, and extended over dune and dune swale habitats, including a burned area (Appendix V, Figs. V-5, 6). Transect 4 (with Plots 18-20) had end points at the railroad and near the river, and crossed disturbed flood plain habitats dominated by shrubs and trees (Appendix V, Figs. V-7, 8). Although Transect 5 (Plots 21-25), with predominantly riparian woodland species, crossed the river, we did not survey elevations within the permanently flooded channel (Appendix V, Figs. V-9, 10). Sections of Transects 5 and 6 crossed secondary drainage channels, although Transect 6 (Plots 26-29), composed of riparian scrub and woodland, did not cross the main river channel (Appendix V, Figs. V-11, 12). Transect 7 (with Plots 30 and 33 on it, and 31 and 32 just slightly off it) was located on the densely wooded flood plain area (Appendix V, Figs. V-13, 14). Predominantly estuarine vegetation dominated Transect 8 (with Plots 34-40), and was situated in the low elevations in the main river mouth (Appendix V, Figs. V-

TABLE 1. Estimated Area and Percent Cover for Each Map Category and Groups of Categories as Illustrated on the Vegetation Map Produced for this Study (See: Appendix II). Area was determined by cutting and weighing vegetation categories of the map and then comparing the weights of areas with the weight of a piece of the map equivalent to a 200 X 200 foot square and converting to acres and hectares. Percent of the total area was determined by comparing the total weight of each category with the total weight of all areas. Marine Wetlands are excluded.

VEGETATION TYPE	Weight (g)	% Total	acres	hectares
WETLANDS AND DEEPWATER HABITATS				
ESTUARINE WETLANDS AND DEEP WATER HABITATS				
Subtidal Deepwater Habitats				
Aquatic Bed (*Ruppia*)	.0004	0.02	.028	.011
Channels	.1556	7.36	10.958	4.436
Intertidal Nonvegetated Wetlands				
Flats and Bars	.0570	2.70	4.014	1.625
Intertidal Emergent Wetlands				
Nonpersistent (*Spergularia*,etc)	.0433	2.05	3.049	1.234
Scirpus maritimus	.0014	.07	0.099	.040
Scirpus, Typha	.0320	1.51	2.250	0.911
Salicornia, Jaumea, Frankenia, Scirpus	.0528	2.50	3.718	1.505
Scrub/Shrub Wetlands				
Atriplex, Salix, Tamarix	.0535	2.53	3.768	1.526
SUBTOTAL (Estuarine)	.3960	18.74	27.884	11.288
RIVERINE WETLANDS AND DEEPWATER HABITATS				
Permanently Flooded Wetlands and Deepwater Habitats				
Channels	.0082	.39	.577	.234
Seasonally/Permanent Flooded Wetlands				
Berula, Ludwigia, etc.	.0296	1.40	2.084	.844
SUBTOTAL (Riverine)	.0378	1.79	2.661	1.078

TABLE 1 cont.

VEGETATION TYPE	Weight (g)	% Total	acres	hectares
PALUSTRINE (VEGETATED) WETLANDS AND TRANSITIONAL HABITATS				
Persistent Emergent Wetlands				
Dune Swale Wetland	.0279	1.32	1.965	.796
River Mouth Swale	.0118	.56	.831	.336
Arundo donax	.0095	.45	.669	.271
SUBTOTAL (Emergent)	.0492	2.33	3.465	1.403
Scrub/Shrub Wetlands (and Transitional Wetland/Upland Habitat)				
Flood Plain Mixed Scrub	.0293	1.39	2.06	.834
Flood Plain Mixed Scrub and Grassland	.1475	6.98	10.387	4.205
Temporary River Channel	.1321	6.25	9.303	3.766
Beach Swale Wetland	.0376	1.78	2.648	1.072
Dune Swale and Saltbrush Wetlands	.1187	5.61	8.359	3.384
Riverbed and Dune Swale	.0274	1.30	1.920	0.777
SUBTOTAL (Scrub/Shrub)	.4926	23.31	34.677	14.038
Forested Wetlands (and Transitional Wetland/Upland Habitat)				
River Channel Margin	.0116	.55	.817	.331
Flood plain Willow	.1323	6.26	9.317	3.772
Flood plain Mixed	.0601	2.84	4.230	1.713
Exposed Riverbed	.0414	1.96	2.920	1.182
SUBTOTAL (Forested)	.2454	11.61	17.284	6.998
SUBTOTAL (Palustrine)	.7872	37.25	55.426	22.439

TABLE 1 cont.

VEGETATION TYPE	Weight (g)	% Total	acres	hectares
UPLANDS				
Coastal Habitats/Vegetation				
Nonvegetated Sand/Cobble	.0645	3.05	4.540	1.838
Vegetated Beach Cobble	.1302	6.16	9.169	3.712
Carpobrotus spp.	.0100	.47	.704	.285
Southern Coastal Dunes	.0748	3.54	5.268	2.133
Coastal Sage Scrub	.0809	3.83	5.697	2.306
SUBTOTAL (Upland)	.3604	17.05	25.378	10.274
RUDERAL HABITATS				
Nonvegetated				
Paths, Unpaved Roads	.1226	5.80	8.634	3.496
Vegetated				
Group Camp (unpaved only)	.1775	8.39	12.510	5.065
Seaside Wilderness Park (Shrubs and/or Herbs)	.0517	2.45	3.641	1.474
Shrubs/Herbs	.0772	3.65	5.437	2.201
SUBTOTAL (Ruderal)	.4290	20.29	30.222	12.236
DEVELOPMENT				
Buildings	.0034	.16	.239	.097
Rock Levees	.0325	1.54	2.289	.927
Paved Roads, RR, etc.	.0682	3.23	4.803	1.945
SUBTOTAL (Development)	.1041	4.93	7.331	2.969
TOTALS (All categories)	2.1145	100.05	148.902	60.284

TABLE 2. Ranking of Map Categories from Largest to Smallest Type. Ranking Based on Data Provided in Table 1 and Map Categories Presented in Appendix II.

MAP CATEGORY	Weight (g)	% Total	acres	hectares
Subtotal Palustrine Wetlands	.7872	37.25	55.426	22.439
Subtotal Palustrine Scrub/Shrub	.4926	23.31	34.677	14.038
Subtotal Ruderal Habitats	.4290	20.29	30.222	12.236
Subtotal Estuarine Wetlands	.3960	18.74	27.884	11.288
Subtotal Upland	.3604	17.05	25.378	10.274
Subtotal Palustrine Forested	.2454	11.61	17.284	6.998
Ruderal Habitats (Group Camp)	.1775	8.39	12.510	5.065
Estuarine Channels	.1556	7.36	10.958	4.436
Palustrine Wetland (Flood Plain Mixed Scrub and Grassland)	.1475	6.98	10.387	4.205
Palustrine Wetland (Flood Plain Willow Forest)	.1323	6.26	9.317	3.772
Palustrine Scrub/Shrub Wetland (Temporary River Channel)	.1321	6.25	9.303	3.766
Upland Vegetated Beach Cobble	.1302	6.16	9.169	3.712
Ruderal Habitats (Paths, Unpaved Roads)	.1226	5.80	8.634	3.496
Dune Swale and Saltbrush Scrub/Shrub Wetlands	.1187	5.61	8.359	3.384
Subtotal Development	.1041	4.93	7.331	2.969
Coast Sage Scrub	.0809	3.83	5.697	2.306
Ruderal Habitats (Shrubs/Herbs)	.0772	3.65	5.437	2.201
Southern Coastal Dunes	.0748	3.54	5.268	2.133
Paved Roads, RR, etc.	.0682	3.23	4.803	1.945
Nonvegetated Sand/Beach Cobble	.0645	3.05	4.540	1.838
Palustrine Wetland (Flood Plain Mixed Forest)	.0601	2.84	4.230	1.713
Ruderal Habitats (Seaside Wilderness Park)	.0517	2.45	3.641	1.474
Estuarine Wetland (Intertidal Flats and Bars)	.0570	2.70	4.014	1.625

TABLE 2 cont.

Estuarine Wetland (*Atriplex, Salix, Tamarix*)	.0535	2.53	3.768	1.526
Estuarine Wetland (*Salicornia, Jaumea, Frankenia, Scirpus*)	.0528	2.50	3.718	1.505
Subtotal Palustrine Emergent	.0492	2.33	3.465	1.403
Estuarine Wetland (*Atriplex, Chenopodium, Spergularia*)	.0433	2.05	3.049	1.234
Subtotal Riverine Wetlands	.0378	1.79	2.661	1.078
Beach Swale Wetland	.0376	1.78	2.648	1.072
Rock Levees	.0325	1.54	2.289	.927
Estuarine Wetland (*Scirpus, Typha*)	.0320	1.51	2.250	.911
Riverine Wetland (*Berula, Ludwigia*, etc.)	.0296	1.40	2.084	.844
Palustrine Wetland (Flood plain Mixed Scrub)	.0293	1.39	2.060	.834
Palustrine Wetland (Dune Swale Emergent Wetland)	.0279	1.32	1.965	.796
Palustrine Wetland (Riverbed and Dune Swale Scrub)	.0274	1.30	1.920	.777
Palustrine Wetland (River Mouth Swale Wetland	.0118	.56	.831	.336
Palustrine Forested Wetland (River Channel Margins)	.0116	.55	.817	.331
Carpobrotus spp.	.0100	.47	.704	.285
Arundo donax	.0095	.45	.669	.271
River Channel	.0082	.39	.577	.234
Buildings	.0034	.16	.239	.097
Estuarine Emergent Wetland (*Scirpus maritimus*)	.0014	.07	.099	.040
Estuarine Aquatic Bed (*Ruppia*)	.0004	.02	.028	.011
TOTAL (excluding subtotals)	2.1145	100.05	148.902	60.284

15, 16). The coastal riparian scrub area at the end of Transect 2 also was the location of Transect 9 (with Plots 41-43; Appendix V, Figs. V-17, 18). Plots 44-49 were located off the transects, and thus elevational data were unavailable for them.

Quantitative Data Analysis. The DECORANA scatterplots for ordination scores for the 49 relevè plots (See: Methods) show fairly consistent patterns in vegetation communities and species groupings (Figs. 31-34). Figures 31 and 33 show scatterplots with plot numbers as labels, and Figures 32 and 34 show the same scatterplots, but with the flooding category of each plot used as labels (See: Table 3), to give an idea of their relative elevations. Twelve main species groups were identified by examining the three most abundant species in each plot (See: Table 4), and delineating the group of plots most similar to each other (i.e., clustered together on the scatterplots) Each species group is dominated by one or two species - some of these species groups may be aggregated to derive fewer species associations.

The twelve main groups are dominated by species belonging to the following communities (See also Table 4 for species names): (1) dune vegetation; (2) beach berm vegetation; (3) estuarine vegetation (persistent); (4) estuarine vegetation (nonpersistent); (5) coastal saltbush scrub; (6) coastal *Baccharis* scrub (transitional); (7) coastal sage scrub; (8) transitional, including elements of (5), (6), and (11); (9) rocky secondary channel bed riparian scrub; (10) riparian willow scrub/ woodland; (11) woodland; and (12) and an outlier plot (dune swale) that was burned, dominated by *Juncus textilis*. These groups are particularly well-identified in Figures 33 and 34 [especially with reference to group (3)], where the data set excluded the nonvegetated categories and where rare species were downweighted in the analysis.

In Figures 32 and 34, a close association can be observed visually between the elevational/flooding category and species composition on each plot. Various trials of regressions and correlations between DECORANA axis-1 scores and elevations for each plot established a significant R-square value of 0.35, with a correlation coefficient of 0.59. Consequently, the first DECORANA ordination axis is closely related to elevation. This relationship is reflected in Figure 35

(where major species groups may be identified), and in Figure 36, where two major groups of plots (low and high elevations) are distinguished.

Further examination of Figures 31 and 32 shows that although a definite positive elevational trend is visible for axis-1, a reverse trend may be apparent in Figures 33 and 34 (except for group 1; group 12 is a random outlier in both cases). This results numerically from the downweighting option, and is not meaningful ecologically. Other environmental factors such as soil salinity and distance from the ocean (i.e., tidal versus riverine influence) may also be related to DECORANA ordination axis-1. For example, in Figures 31 and 32, species groups grade from beach and persistent estuarine through nonpersistent estuarine, coastal scrub, riverine, and woodland communities (i.e., saline/tidal/coastal to freshwater/inland communities). Exclusion of nonvegetated "species" and downweighting rare species (e.g., annuals) in Figures 33 and 34 reveals this pattern even more strongly. Consequently, a complex of inter-related environmental factors such as elevation, flooding, salinity, and distance from the ocean may be related to axis-1. Increasing ordination scores on DECORANA axis-2 also show a "salinity trend" from high to low salinity-tolerant communities; however, this trend is not particularly clear, and is confused with a coastal/ inland trend, because coastal communities occur either at both ends of the axis (Figs. 31 and 32) or show no distinct relation to axis-2 (Figs. 33 and 34).

TWINSPAN Tables V-2 to V-5 in Appendix V have been given for the entire data set (Figs. 32 and 33), and for data excluding nonvegetated "species". Tables V-2 and V-4 represent the 50 most common species, whereas Tables V-3 and V-5 include all species. The tables show good partitioning between riparian woodland and coastal scrub species on the left side of the table, estuarine, salt marsh, and dune species on the right side of the table, and with indifferent/ ubiquitous/ weedy riparian scrub species arranged in the middle. Classification of plots corresponds closely with DECORANA groupings.

Flora

Our investigation of the flora of the study area focused on an inventory of all vascular plants and marine algae, including those documented by herbarium specimens. Not included in this study are nonvascular groups such as lichens,

TABLE 3. VENTURA RIVER MOUTH: Releve Plots Data, Aug.-Sep. 1988.

Plot Number	Slope (degrees from north) *	Aspect (degrees from north) *	Southness Index cosine(aspect) x sine(slope) *	Elevation above mean sea level in meters	Descriptive flooding index **	Average canopy height in meters (tree/shrub/herb)	Tree species structural data ***
1	0	NA	NA	2.513	4	3.0/2.0/ -	
2	0	NA	NA	2.467	4	3.0/2.0/ -	
3	0	NA	NA	2.280	3	- /1.0/ -	
4	0	NA	NA	2.079	3	- / - /0.4	
5	2	20	0.033	2.353	4	- / - /0.2	
6	0	NA	NA	2.117	3	- /1.5/ -	
7	0	NA	NA	1.544	3	- / - /0.3	
8	0	NA	NA	1.435	3	- / - /0.5	
9	0	NA	NA	1.424	3	- / - /1.0	
10	2	70	0.012	0.459	1	- / - /0.8	
11	1	70	0.006	0.784	2	- / - /0.3	
12	1	70	0.006	1.174	2	- / - /0.1	
13	3	60	0.026	2.159	3	- / - /0.2	
14	3	200	-0.049	2.606	4	- / - /2.0	
15	0	NA	NA	2.104	3	- /1.5/ -	
16	U	NA	NA	3.484	4	- / - /0.25	
17	U	NA	NA	2.734	4	- / - /0.25	
18	0	NA	NA	3.640	4	4.0/3.0/ -	*M l* (2): 56.56 *S lo* (6): 540.75
19	0	NA	NA	2.880	4	4.0/2.0/ -	*S lo* (18): 787.56
20	2	40	0.027	2.879	4	- /2.5/ -	
21	6	100	-0.018	4.469	4	4.0/ - / -	*P a* (1): 19.64 *S lo* (3): 769.49 *S lv* (1): 19.64
22	V	NA	NA	2.082	3	4.0/ - / -	*S lo* (2): 78.56 *S lv* (6): 841.16
23	5	97	-0.011	2.081	3	4.0/ - / -	*S la* (8): 732.38
24	0	NA	NA	5.245	4	- /1.0/ -	
25	0	NA	NA	5.347	4	- /1.5/ -	
26	V	NA	NA	3.138	4	3.0/ - / -	
27	0	NA	NA	3.413	4	3.0/ - / -	
28	0	NA	NA	3.917	4	- / - /1.5	
29	V	NA	NA	3.638	4	2.5/ - / -	
30	0	NA	NA	3.364	4	5.0/2.0/ -	*P a* (7): 2436.31 *S lo* (9): 1434.92
31	1	235	-0.010	NA	4	5.0/2.0/ -	*J c* (14): 739.85 *P a* (1): 962.11 *S lo* (6): 39.27
32	0	NA	NA	NA	4	5.0/1.75/ -	*S lo* (7): 1477.92
33	15	95	-0.023	3.049	4	5.0/1.75/ -	*S lo* (17): 2197.35
34	3	247	-0.021	1.056	2	- / - /0.3	
35	1	340	0.016	1.426	3	- / - /0.2	
36	3	67	0.021	0.877	2	- / - /0.3	
37	0	NA	NA	0.632	1	- / - /0.2	
38	0	NA	NA	1.622	3	- / - /1.25	
39	0	NA	NA	1.282	3	- / - /1.5	
40	0	NA	NA	1.562	3	- / - /1.0	
41	0	NA	NA	2.277	3	- /1.0/ -	
42	0	NA	NA	2.265	3	- /1.2/ -	
43	0	NA	NA	2.213	3	- /1.5/ -	
44	0	NA	NA	NA	3	- /1.0/ -	
45	6	20	0.098	NA	4	- / - /0.1	
46	10	207	-0.155	NA	4	- / - /0.2	
47	0	NA	NA	NA	4	- / - /1.5	
48	0	NA	NA	NA	4	- /1.25/1.0	
49	0	NA	NA	NA	4	- /1.5/ -	

* U = undulating; V = variable; NA = not applicable/data not available

** 1 = permanently flooded (elevation approximately < 0.5 m); 2 = irregularly flooded by tides and ponding (0.5-1.75 m); 3 = seasonally flooded by runoff (1.5-2 m); 4 = rarely flooded by runoff (> 2.5 m)

*** Species (number of individuals): total basal area in sq. cm.
Species: *J c* = *Juglans californica; M l* = *Malosma laurina; P a* = *Populus alba; S la* = *Salix lasiandra; S lo* = *Salix lasiolepis; S lv* = *Salix laevigata*

TABLE 4. VENTURA RIVER MOUTH:
Releve Plots with a list of the most abundant species in each plot.*

Plot Number	Two/three most abundant species (species computer list number)
1	*Atriplex lentiformis* (14); *Baccharis pilularis* (20); *Toxicodendron diversilobum* (112)
2	*Atriplex lentiformis* (14); *Salix lasiolepis* (94); *Baccharis pilularis* (20)
3	*Atriplex lentiformis* (14); bare ground (118); *Cardaria draba* (32)
4	*Salicornia virginica* (98); *Frankenia salina* (54); beach sand (119)
5	Rocks/cobbles/berm (120); *Cakile maritima* (28); *Heliotropium curassavicum* (58)
6	*Atriplex lentiformis* (14); *Solidago occidentalis* (108); *Baccharis pilularis* (20)
7	*Jaumea carnosa* (61); *Distichlis spicata* (46); *Salicornia virginica* (98)
8	*Salicornia virginica* (98); *Artemisia biennis* (7); *Jaumea carnosa* (61)
9	*Scirpus californicus* (99); *Jaumea carnosa* (61); *Artemisia biennis* (7)
10	*Scirpus maritimus* (100); water (121); *Salicornia virginica* (98)
11	*Jaumea carnosa* (61); *Salicornia virginica* (98); *Scirpus maritimus* (100)
12	*Distichlis spicata* (46); beach sand (119); *Jaumea carnosa* (61)
13	beach sand (119); *Ambrosia chamissonis* (3); rocks/cobbles/berm (120)
14	*Juncus textilis* (63); *Tetragonia tetragonioides* (111); *Conium maculatum* (38)
15	*Atriplex lentiformis* (14); *Cardaria draba* (32); bare ground (118)
16	beach sand (119); *Ambrosia chamissonis* (3); *Camissonia cheiranthifolia* (31)
17	beach sand (119); *Ambrosia chamissonis* (3); rocks/cobbles/berm (120)
18	*Senecio mikanioides* (104); *Arundo donax* (10); *Salix lasiolepis* (94)
19	*Senecio mikanioides* (104); *Salix lasiolepis* (94); *Baccharis salicifolia* (21)
20	*Toxicodendron diversilobum* (112); *Baccharis salicifolia* (21); *Atriplex lentiformis* (14)
21	*Salix lasiolepis* (94); *Baccharis salicifolia* (21); *Populus alba* (84)
22	*Salix laevigata* (92); *Salix lasiolepis* (94); *Arundo donax* (10)
23	*Salix lasiandra* (93); *Ludwigia peploides* (70); *Salix lasiolepis* (94)
24	*Brassica geniculata* (24); *Bromus diandrus* (25); *Artemisia californica* (8)
25	*Brassica geniculata* (24); *Atriplex lentiformis* (14); *Artemisia californica* (8)
26	*Salix lasiolepis* (94); *Baccharis salicifolia* (21); *Melilotus alba* (75)
27	*Salix lasiolepis* (94); rocks/cobbles (120); *Baccharis salicifolia* (21)
28	*Melilotus alba* (75); upper river bed (118); rocks/cobbles (120)
29	*Salix lasiolepis* (94); *Baccharis salicifolia* (21); upper river bed (118)
30	*Toxicodendron diversilobum* (112); *Populus alba* (84); *Salix lasiolepis* (94)
31	*Toxicodendron diversilobum* (112); *Populus alba* (84); *Juglans californica* (62)
32	*Salix lasiolepis* (94); *Toxicodendron diversilobum* (112); *Clematis ligusticifolia* (37)
33	*Salix lasiolepis* (94); *Toxicodendron diversilobum* (112); *Arundo donax* (10)
34	*Atriplex patula* (16); *Spergularia marina* (110); *Chenopodium macrospermum* (36)
35	*Cotula coronopifolia* (41); *Cynodon dactylon* (43); *Spergularia marina* (110)
36	*Atriplex patula* (16); lower river mouth sand (119); *Chenopodium macrospermum* (36)
37	*Atriplex patula* (16); rocks/cobbles (120); water (121)
38	*Scirpus californicus* (99); *Typha domingensis* (113); *Atriplex patula* (16)
39	*Scirpus californicus* (99); *Atriplex patula* (16); *Jaumea carnosa* (61)
40	*Distichlis spicata* (46); *Jaumea carnosa* (61); *Atriplex patula* (16)
41	*Baccharis pilularis* (20); bare ground (118); *Isocoma veneta* (60)
42	*Baccharis pilularis* (20); *Bromus diandrus* (25); *Baccharis salicifolia* (21)
43	*Atriplex lentiformis* (14); *Baccharis pilularis* (20); *Baccharis salicifolia* (21)
44	*Atriplex lentiformis* (14); *Euphorbia lathyris* (51)
45	beach sand (119); *Abronia umbellata* (1); *Ambrosia chamissonis* (3)
46	beach sand (119); *Abronia umbellata* (1); *Ambrosia chamissonis* (3)
47	*Melilotus alba* (75); upper river bed (118); rocks/cobbles (120)
48	upper river bed (118); rocks/cobbles (120); *Baccharis salicifolia* (21)
49	*Artemisia californica* (8); *Brassica geniculata* (24); *Anagallis arvensis* (5)

*Subspecies and varieties not listed, see Appendix VIII—Annotated Catalogue of the Vascular Plants.

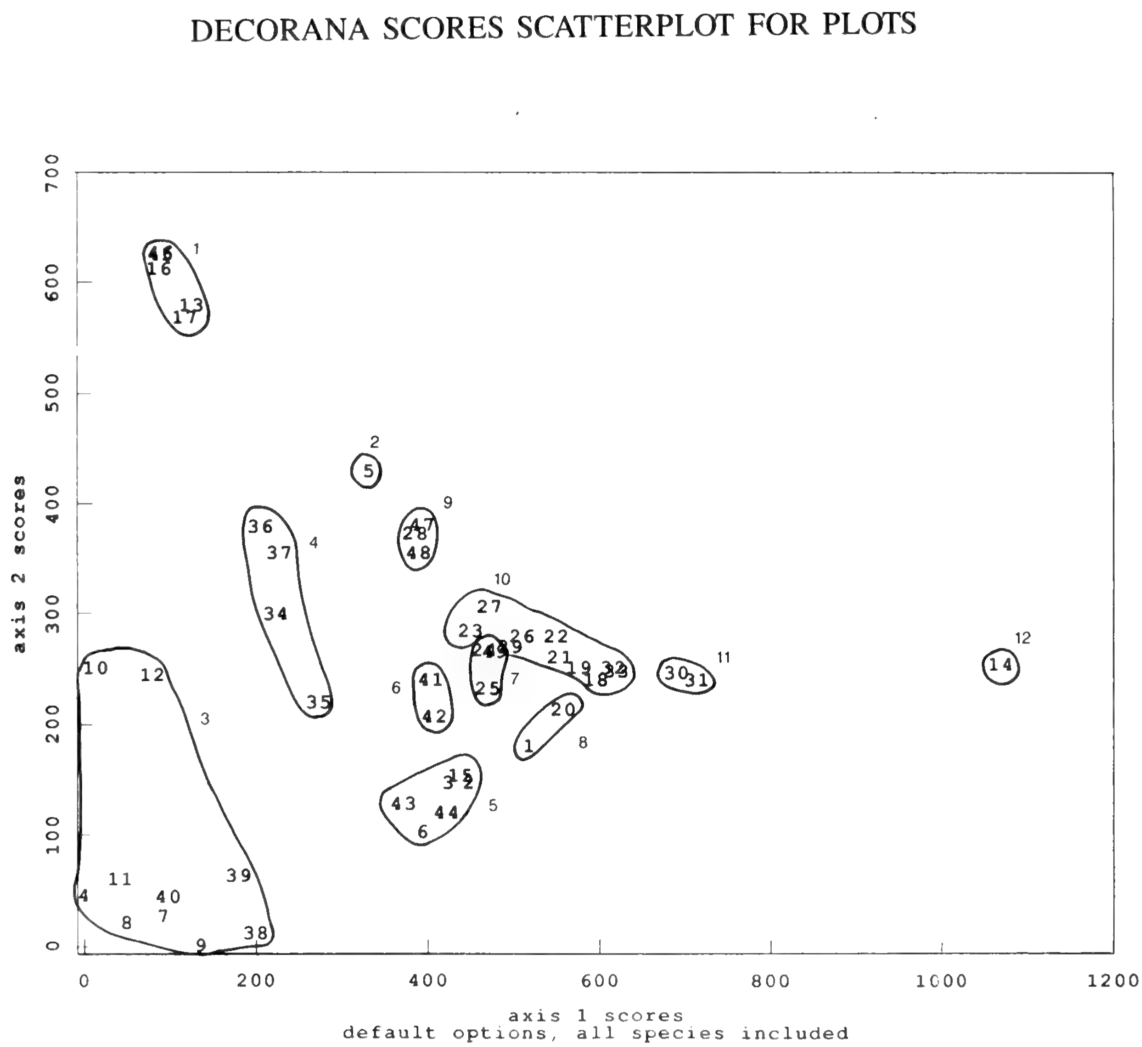

FIG. 31. DECORANA AXIS-1 VS. AXIS-2 FOR VENTURA RIVER PLOTS. Eigenvalues: axis-1 = 0.934; axis-2 = 0.770. Data set includes non-vegetated areas; rare species not downweighted in analysis. See Table 4 for lists of dominant species for each plot.

Group	"Community"	Group	"Community"
1	dune vegetation	7	coastal sage scrub
2	beach berm vegetation	8	transitional (including 5, 6, 7)
3	estuarine vegetation (persistent)	9	rocky secondary channelbed riparian scrub
4	estuarine vegetation (nonpersistent)	10	riparian willow scrub/woodland
5	coastal saltbush scrub	11	riparian woodland
6	coastal baccharis scrub	12	dune swale (*Juncus textilis*, burned).

DECORANA SCORES SCATTERPLOT FOR PLOTS

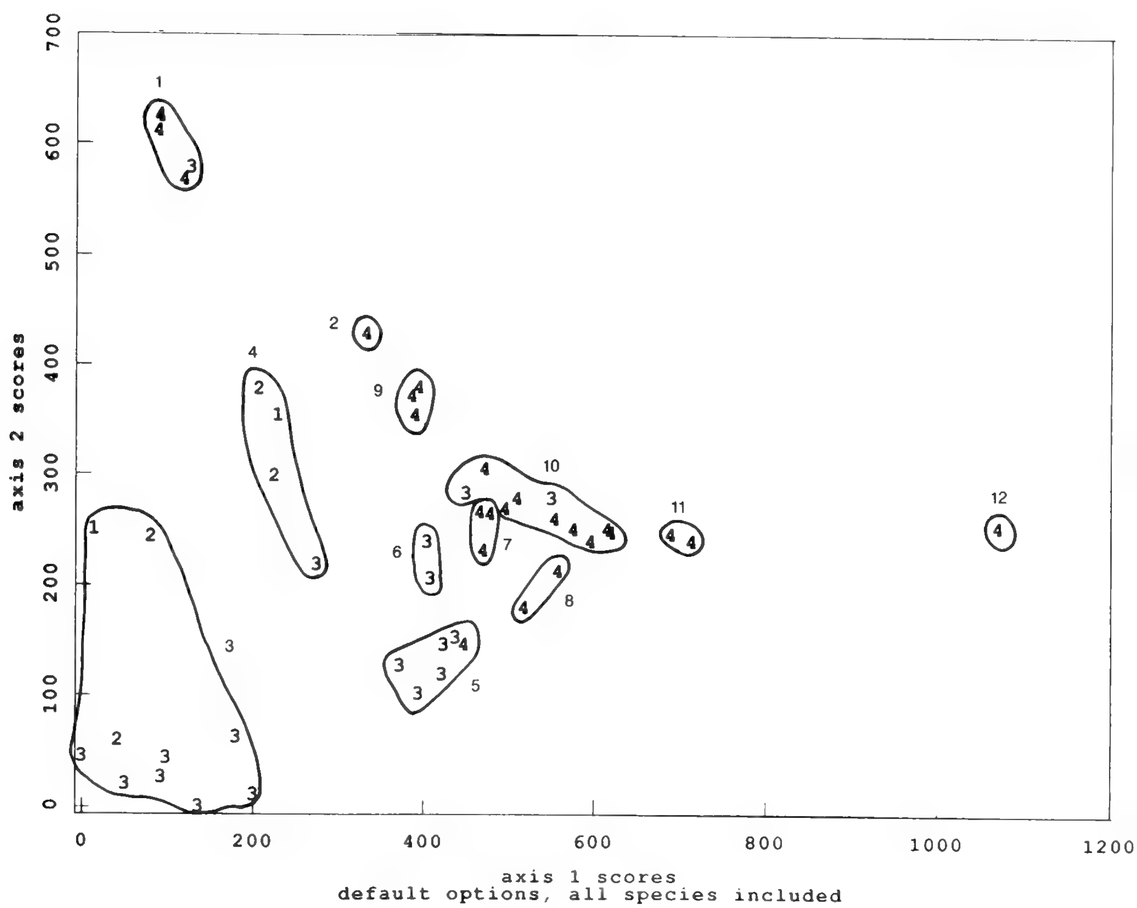

FIG. 32. DECORANA AXIS-1 VS. AXIS-2 FOR VENTURA RIVER PLOTS. Eigenvalues: axis-1 = 0.934; axis-2 = 0.770. Numbers (1-4) represent different flooding regimes (see below). See Figure 31 for explanation of numbered groups (1-12).

1 = permanently flooded (elev. < 0.5m)

2 = irregularly flooded by tides and ponding (elev. 0.5 - 1.75m)

3 = seasonally flooded by runoff (elev. 1.5-2m)

4 = rarely flooded by runoff (elev. > 2.5m)

DECORANA SCORES SCATTERPLOT FOR PLOTS

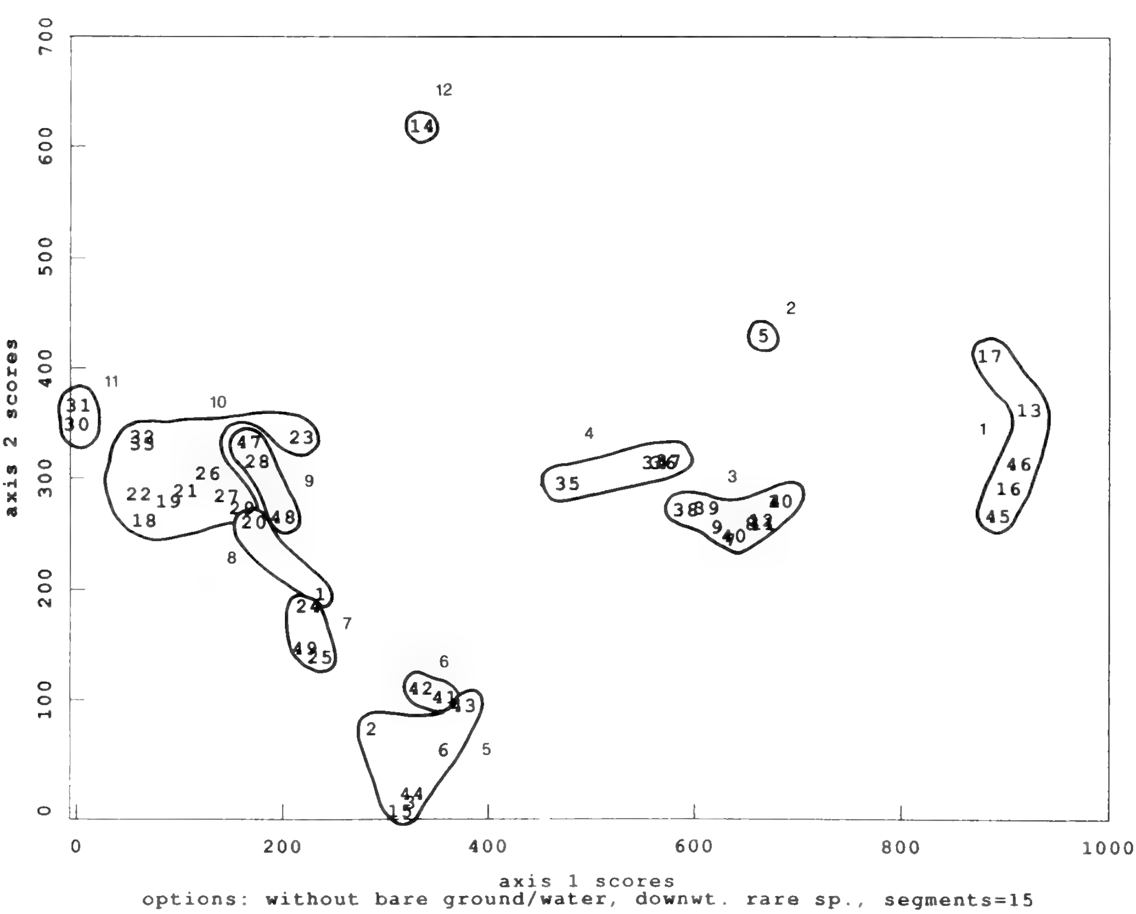

FIG. 33. DECORANA AXIS-1 VS. AXIS-2 FOR VENTURA RIVER PLOTS. Eigenvalues: axis-1 = 0.942; axis-2 = 0.856. Data set excludes non-vegetated areas; rare species are downweighted in analysis. See Table 4 for lists of dominant species for each plot.

Group	"Community"	Group	"Community"
1	dune vegetation	7	coastal sage scrub
2	beach berm vegetation	8	transitional (including 5, 6, 7)
3	estuarine vegetation (persistent)	9	rocky secondary channelbed riparian scrub
4	estuarine vegetation (nonpersistent)	10	riparian willow scrub/woodland
5	coastal saltbush scrub	11	riparian woodland
6	coastal baccharis scrub	12	dune swale (*Juncus textilis*, burned).

DECORANA SCORES SCATTERPLOT FOR PLOTS

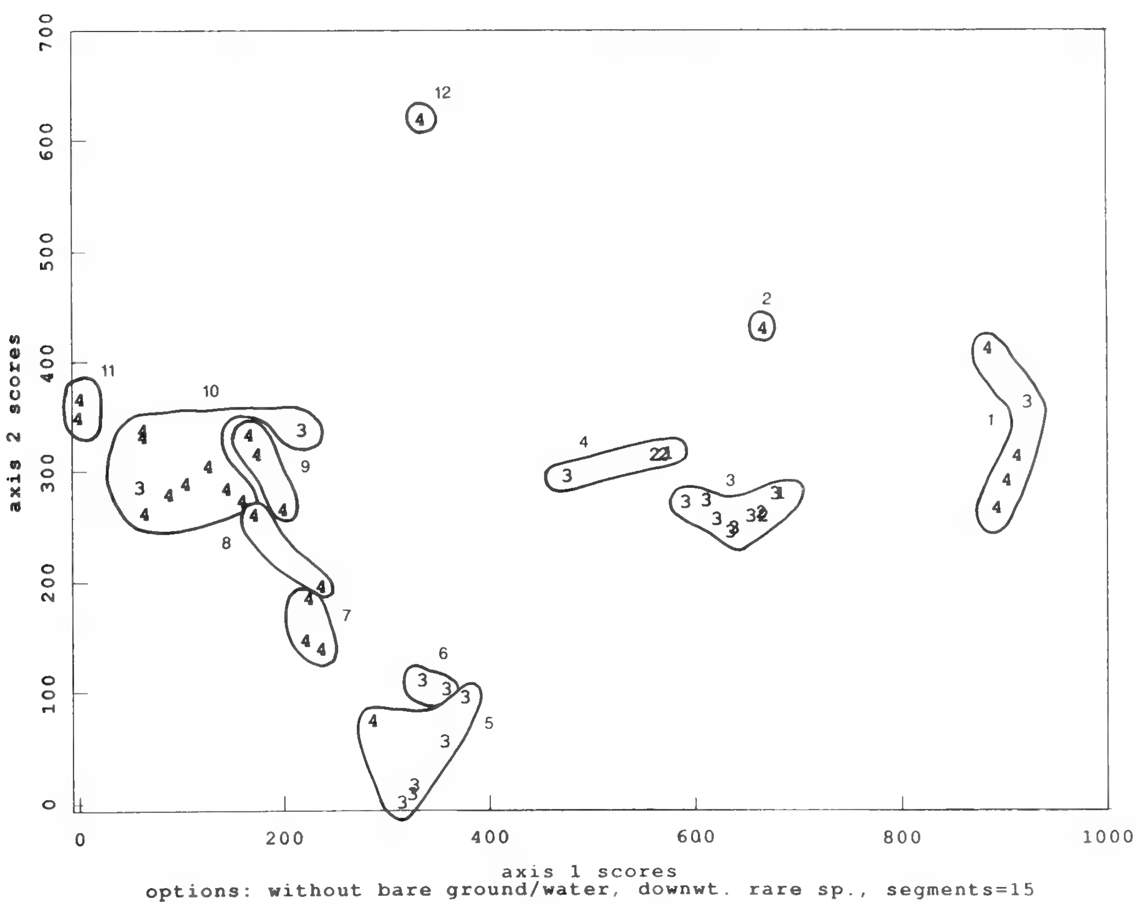

FIG. 34. DECORANA AXIS-1 VS. AXIS-2 FOR VENTURA RIVER PLOTS. Eigenvalues: axis-1 = 0.934; axis-2 = 0.770. Numbers (1-4) represent different flooding regimes (see below). Data set excludes non-vegetated areas; rare species are downweighted in analysis. See Figure 33 for explanation of numbered groups (1-12).

1 = permanently flooded (elev. < 0.5m)

2 = irregularly flooded by tides and ponding (elev. 0.5 - 1.75m)

3 = seasonally flooded by runoff (elev. 1.5-2m)

4 = rarely flooded by runoff (elev. > 2.5m)

SCATTERPLOT FOR PLOTS WITH REGRESSION LINE

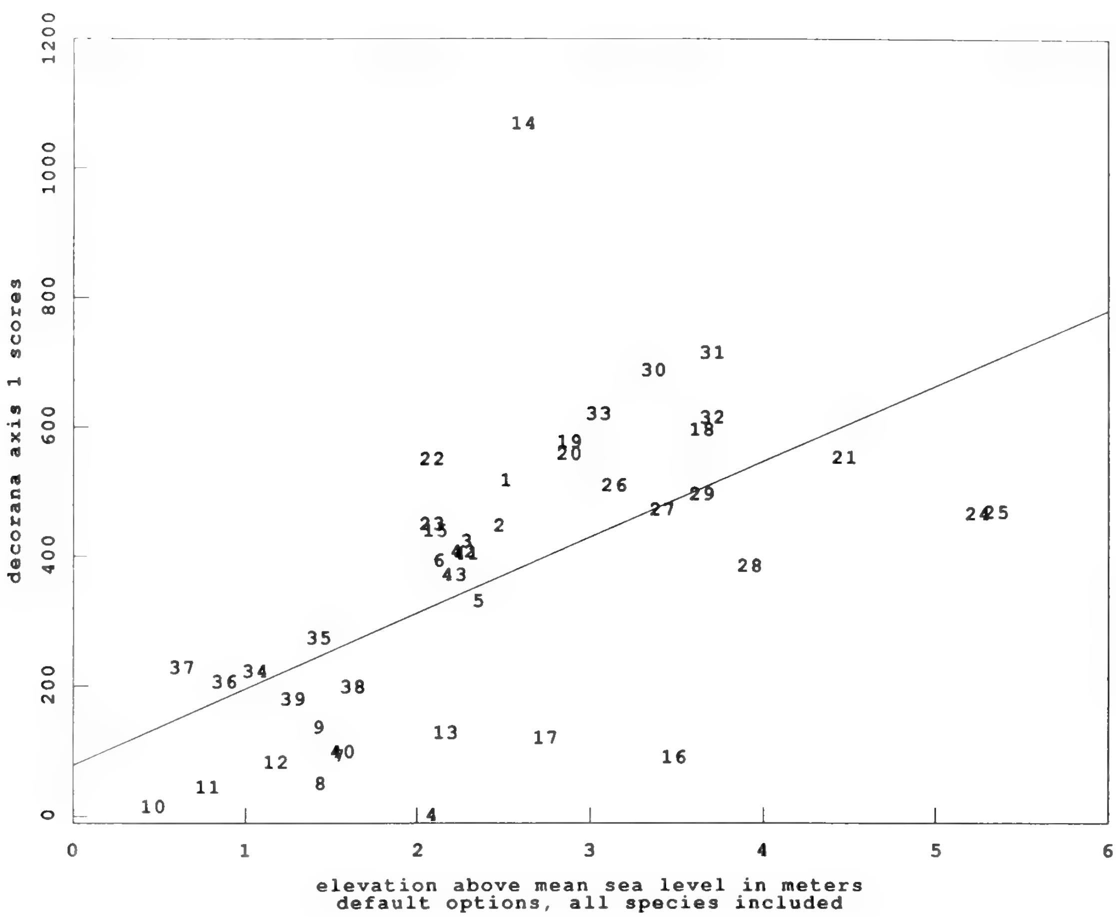

FIG. 35. SCATTERPLOT WITH REGRESSION LINE FOR VENTURA RIVER MOUTH STUDY PLOTS (numbered). A close relationship between plots (species composition) and elevation is displayed. Plots with species composition reflecting frequent flooding conditions and lower elevations are clustered in the lower left, whereas plots with species composition reflecting irregular or rare flooding occur toward center or right. See Table 4 for list of dominant plants for each plot.

SCATTERPLOT FOR PLOTS WITH REGRESSION LINE

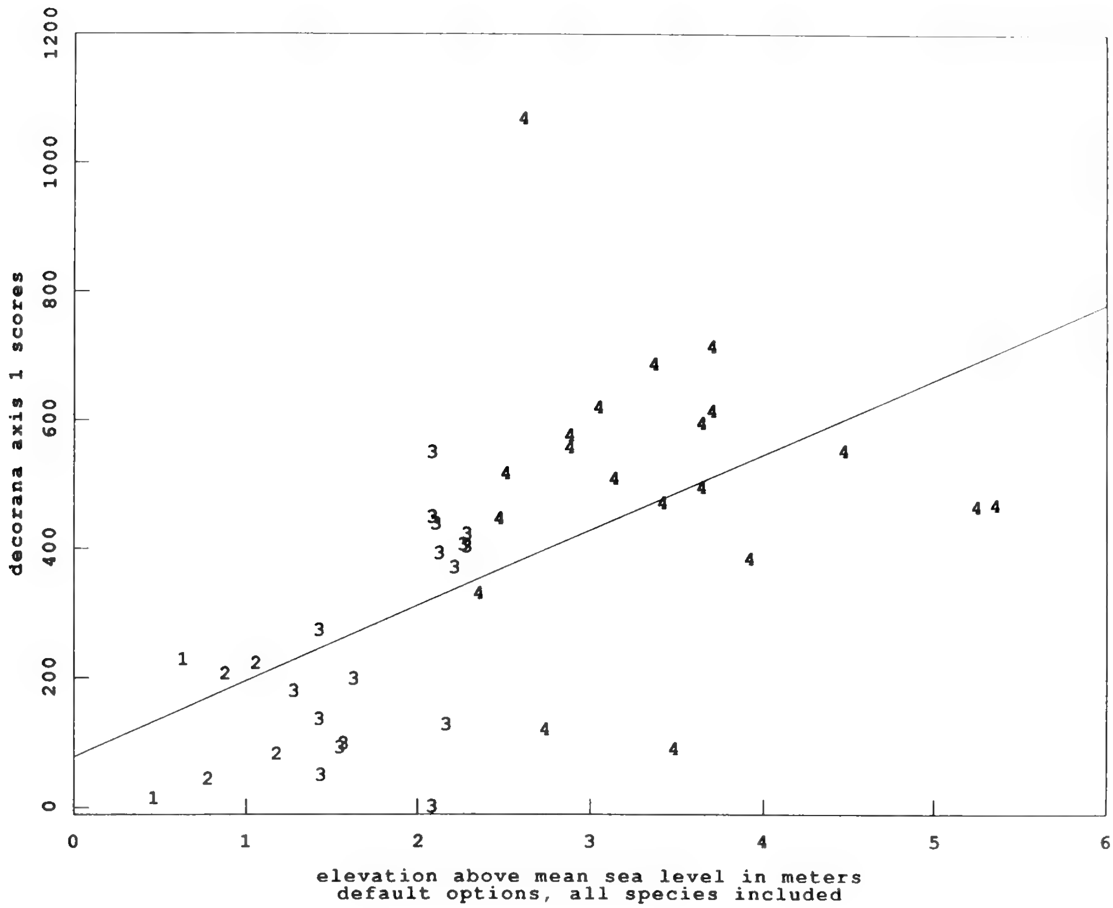

FIG. 36. SCATTERPLOT WITH REGRESSION LINE FOR VENTURA RIVER MOUTH STUDY PLOTS (represented by numbered flooding regimes).

1 = permanently flooded (elev. < 0.5m)

2 = irregularly flooded by tides and ponding (elev. 0.5-1.75m)

3 = seasonally flooded by runoff (elev. 1.5-2m)

4 = rarely flooded by runoff (elev. > 2.5m) (wetland/upland transitional habitats)

Plots with permanently or irregularly flooded regimes are clustered at lower elevations, and plots with seasonal or rare flooding regimes are clustered at higher elevations.

mosses, and fungi. This information is presented in the form of : 1) a discussion of previous botanical investigations; 2) annotated catalogues and checklists of the marine algae and vascular plants (Appendices VI, VII, VIII, IX); 3) a summary of the inventory; 4) a discussion of species of special biological interest; and 5) documentation and discussion of invasive exotic vascular plants.

History of Botanical Investigation. Our earliest records of botanical investigation date to Henry M. Pollard (1886-1973). Pollard was a teacher in local private schools who also collected the flora of the Ventura River Watershed for about 30 years beginning in 1944 (Smith 1976). The majority of his collections are deposited in the California Academy of Sciences (CAS), and the Santa Barbara Botanical Garden (SBBG), which includes those from the Santa Barbara Museum of Natural History (SBM). Many duplicate specimens are housed in herbaria of various institutions including Rancho Santa Ana Botanic Garden (RSA) and the University of California, Santa Barbara (UCSB). A card file of his collection from the Ventura River Watershed is housed at SBBG. Pollard's collections have been helpful in documenting aspects of the flora in the vicinity of the Ventura River Mouth, although most of his work was apparently conducted away from the coast and higher in the watershed. Although he intended to publish a flora of the Ventura River Watershed, he never extended this effort beyond a manuscript on the monocots (Smith 1976). Many of his collections and records for the Ventura and Santa Barbara regions are cited in Smith (1976).

E. Yale Dawson (1918-1966) was one of the major contributors to our knowledge of the marine algae of the Pacific Coast. He collected the marine flora from the eastern portions of the Ventura River Delta from 1956 through 1959 as part of a water pollution study of the southern California coast from Point Conception to the Mexican Border. Voucher specimens from this effort were originally housed with the Allen Hancock Foundation of the University of Southern California, and are now housed at the Los Angeles County Museum of Natural History.

Other investigations of the botanical resources that concentrated on our study area include four generalized vegetation maps and/or species lists produced for CALTRANS by James Barry (North American School of Conservation and Ecology 1972), for the Ventura County Fish and Game Commission (Capelli

1973), for the State Beach Management Plan (California Department of Parks and Recreation 1975), and for a UCSB student research project (Boyle 1976). These efforts did not include detailed floristic inventories or the collections of voucher specimens.

In 1982, David Magney and Rick Burgess began the Flora of Ventura County Project in association with the UCSB Herbarium. In 1987, the UCSB Herbarium initiated the Ventura River and Estuary Botanical Survey, funded in part by Patagonia, Inc. The current study of Emma Wood State Beach funded in part by the California Department of Parks and Recreation has developed out of these larger efforts that continue simultaneously with the more focused effort. Capelli has been responsible primarily for the inventory of marine algae and the production of the Annotated Catalogue (Appendix VI) and Checklist (Appendix VII). Magney and Ferren have been responsible for the inventory of vascular plants and the production of the Annotated Catalogue (Appendix VIII) and Checklist (Appendix IX).

Summary of the Catalogues. Annotated catalogues of the marine algae (Appendix VI) and the vascular plants (Appendix VIII) were prepared as products of the inventory of botanical resources. Summaries of the catalogues for algae and vascular plants are reported separately.

Marine Algae. As of September 1989, we have observed and collected vouchers for 107 species of marine algae in the study area, representing 59 genera in four divisions (See Appendix VI). Fourteen of the species were identified only to genus. In addition, one species of marine angiosperm, *Phyllospadix torreyi*, also has been collected. A second species, *P. scouleri*, has been previously reported by Dawson (1956), but the identification is uncertain. All of the species collected are native, except for one species of brown algae, *Saragasum muticum*, which was introduced to the west coast from Japan about 1945 through the importation of juvenile oysters to British Columbia. Rhodophyta is the division with the largest number of taxa (78), with 20 in the division Chlorophyta, and 9 in the division Phaeophyta. The genus represented by the largest number of species was *Gigartina* (Rhodophyta), with 9 species.

Vascular Plants. As of February 1990, we have observed, found citations of, located herbarium specimens for, or collected vouchers of 314 species representing 207 genera and 67 families of vascular plants (Appendices VIII, IX). Of this total, 167 (53%) are native species and 147 (47%) are naturalized or persistent cultivated species. The Asteraceae and Poaceae are represented by the greatest number of species, 62 (20%) and 38 (12%), respectively. Other families and their representation are reported in Table 5. The genus represented by the largest number of species is *Atriplex* (Chenopodiaceae), with six native and two naturalized species, and three hybrids recorded from the study area.

Table 5. List of Vascular Plant Families with Largest Representation in the Study Area.

FAMILY	# Species	# Native	# Exotic	% Flora
Asteraceae	62	35 (56%)	27 (44%)	20%
Poaceae	38	5 (13%)	33 (87%)	12%
Chenopodiaceae	20	11 (55%)	9 (45%)	6%
Brassicaceae	16	5 (31%)	11 (69%)	5%
Fabaceae	13	6 (46%)	7 (54%)	4%
Polygonaceae	13	8 (62%)	5 (38%)	4%
Cyperaceae	12	10 (83%)	2 (17%)	4%
Solanaceae	9	3 (33%)	6 (67%)	3%
TOTAL (8)	183	83 (45%)	100 (55%)	58%

We have not separated the occurrence of plants among the three study sites within the general study area because many are ubiquitous or because various habitat types occur in each site, and thus duplicate the potential occurrence of species. However, there are notable exceptions where native species are restricted to specific sites. At the Ventura River Group Camp, for example, dunes support Sand Verbena (*Abronia umbellata*) and Beach Evening Primrose (*Camissonia cheiranthifolia* ssp. *suffruticosa*); dune swales support Basket Rush (*Juncus textilis*), Wooly Sea-blite (*Suaeda taxifolia*), and Marsh Horseweed (*Conyza coulteri*); the Second Mouth Estuary supports Alkali Bulrush (*Scirpus maritimus*) and Spiral Ditch-grass (*Ruppia cirrhosa*); and the riparian forest includes Southern California Black Walnut (*Juglans californica*). At Seaside Wilderness Park, the unique River Mouth Swale provides habitat for Spiny Rush (*Juncus acutus* var. *sphaerocarpus*) and Marsh Cinquifoil (*Potentilla anserina*). At the Hubbard Property, riverine wetlands provide habitat for Water-parsnip (*Berula erecta*) and Dotted Water

Smartweed (*Persicaria punctata*). Each of the three study sites, therefore, contributes to the overall richness of the habitats and botanical resources.

Species of Special Interest. Species of special interest include taxa that are (1) fully protected by Federal or State law, (2) candidates for listing, or (3) identified as species of special interest or concern by public agencies, societies, and knowledgeable individuals.

Fully protected species include plants or wildlife that are listed (1) as threatened or endangered by the U.S. Fish and Wildlife Service (1989) or (2) as rare, threatened, or endangered by the California Department of Fish and Game (California Resources Code Title 14 670.2). Candidates for State-listing are provided the same legal status as those officially listed (California Fish and Game Commission Code Sections 1904 and 2072.7).

Federal candidate species include several categories. Category 1 (C1) candidates consist of taxa for which enough data are on file to support federal listing as threatened or endangered. Category 2 (C2) candidates consist of taxa for which the threat and/or distribution data are insufficient to support federal listing as threatened or endangered. Category 3 (C3) candidates consist of taxa that are either thought to be extinct, taxonomically invalid, or too widespread and/or not threatened to warrant Federal listing (U.S. Fish and Wildlife Service 1989).

The California Natural Diversity Data Base (NDDB), part of the California Department of Fish and Game, has developed a list of "Special Plants" that includes taxa in the categories described above as well as (1) taxa that may be considered endangered or rare under Section 15380(d) of the California Environmental Quality Act guidelines; (2) Bureau of Land Management, USFWS, or U.S. Forest Service "Sensitive Species"; (3) taxa that are biologically rare, very restricted in distribution, or declining throughout their range but not currently threatened with extirpation; (4) populations in California that may be peripheral to the major portion of a taxon's range but are threatened with extirpation in California; and (5) taxa closely associated with a habitat that is declining in California at an alarming rate (e.g., wetlands, riparian corridors, old growth forests, desert aquatic systems, native grasslands, valley shrubland habitats, vernal pools, etc.) (NDDB 1987).

The California Native Plant Society (CNPS) has developed an inventory of rare and endangered vascular plants of California that contains several lists that are described below (Smith and Berg 1988): (1) List 1A: Plants presumed extinct in California; (2) List 1B: Plants rare, threatened, or endangered in California and elsewhere; (3) List 2: Plants rare, threatened, or endangered in California, but more common elsewhere; (4) List 3: Plants about which we need more information - a review list; and (5) List 4: Plants of limited distribution - a watch list (Smith and Berg 1988).

The Santa Barbara Botanic Garden (SBBG) has developed a list of "special plants of local concern from upland habitats" (SBBG 1988a) and "plants of local concern from wetland habitats" (SBBG 1988b). Some of these taxa may be added to the CNPS's inventory in future editions.

No Federally listed (U.S. Fish and Wildlife Service 1989) or candidate "endangered" or "threatened" plant species (U.S. Fish & Wildlife Service 1985; Smith and Berg 1988) or State listed as candidate "rare" or "endangered" plant species (California Department of Fish and Game 1987; Smith and Berg 1988) were observed in the study area by this research team. However, several species of interest listed by agencies or societies occur in the study area or have been reported from the region. We provide comment, clarification, and correction of these reports. The locations of various species of special interest are noted on Figure 37.

Gambell's Water-cress (*Rorippa gambellii* (S. Wats.) Roll. & Al-Schbaz, Brassicaceae). Gambell's Water-cress is a (C2) Federal candidate and a recently listed State endangered species. It is considered by the NDDB (1989) as "possibly threatened, needs more information" and occurs on the CNPS's List 1B (1988) as "endangered throughout its range". NDDB and CNPS records for Ventura County are based on a single collection from the Ventura River Delta [tidal marsh, *Arbaugh 16*, 2 May 1966 (OBI)]. Although originally identified as *Nasturtium officinale* (=*Rorippa nasturtium-aquaticum*), this specimen was subsequently annotated as *Cardamine gambelli*? (=*R. gambellii*) by an unknown investigator. Personal examination of this specimen by W. R. Ferren at UCSB in 1989 and of a xerox of the specimen by R. Price at UC (pers. comm. 1989) reveals that the Arbaugh specimen is Water-cress (*R. nasturtium-aquaticum*). Thus, there are

Fig. 37. Distribution of Species of Special Interest

Plants

1. Spiny Rush
2. California Walnut
3. Southern California Locoweed
4. Nuttall's Chaparral Mallow
5. Yerba Mansa

Animals

6. Tidewater Goby
7. Snowy Plover
8. Western Pond Turtle
9. Monarch Butterfly (historic roost)
10. Tiger Beetle (historic habitat ?)
11. Belding's Savannah Sparrow
12. California Least Tern
13. Legless Lizard

Botanical Resources at Emma Wood State Beach and the Ventura River Estuary: Inventory and Management.
Herbarium of the University of California, Santa Barbara 1989.

apparently no records for Gambell's Water-cress from Ventura County.

Ventura Marsh Milk-vetch (*Astragalus pycnostachyus* Gray var. *lanosissimus* (Rydb.) Munz & McBurn, Fabaceae). Ventura Marsh Milk-vetch is a C1 Federal candidate. It is listed by NDDB (1988) as a "very rare, endangered or threatened subspecies" and by the CNPS (Smith and Berg 1988) on List 1A as: presumed extinct, and last seen in 1967. They also report that, "Recent attempts to rediscover this plant have been unsuccessful. Habitat lost to urbanization." In the vicinity of the study area, Ventura Marsh Milk-vetch was last seen in 1911, based on a collection from "Ventura" (Essig. s.n.) in the Jepson Herbarium (NDDB 1989). However, there is no conclusive evidence that this species was collected in the study area or that the appropriate habitat (type of wetland?) occurred here.

Aphanisma (*Aphanisma blitoides* Nutt. ex Moq. in DC., Chenopodiaceae). Aphanisma is a C2 Federal candidate species, and is also listed on CNPS List 3 (Smith and Berg 1988) as a plant for which more information on rarity and endangerment is needed. Aphanisma occurs from Pt. Sal in Santa Barbara County southward to Baja California; it also is reported from most of the Channel Islands (Munz 1974). It is restricted to coastal bluff and coastal strand habitats such as the lower bluffs at Taylor Ranch approximately 1.5 miles west of the Ventura River [*Pollard* s.n. 1 Jun 1963 (PCF)]. This is the only record of the species from Ventura County; it has not been collected from within the study area, although the proximity of the Taylor Ranch site (now within Emma Wood State Beach?) and occurrence of apparently appropriate habitats at the Ventura River Group Camp suggest that it might have occurred here previously.

Spiny Rush (*Juncus acutus* L. var. *sphaerocarpus* Engelm., Juncaceae). Spiny Rush (Fig. 38) is listed on the CNPS List 4 (Smith and Berg 1988) as a plant with limited distribution that is not endangered at this time, but that is threatened by urbanization and should be monitored regularly to determine any change in status. Ferren et al. (1987) noted that it has been extirpated from the South Coast of Santa Barbara County. Many coastal populations could be threatened with extirpation by as little as a 1-foot rise in sea level. In the study area, Spiny Rush occurs in the "River Mouth Swale" in Seaside Wilderness Park on the east side of the Ventura River Estuary, south of the southern Pacific Railroad (Fig. 37). About 12 plants occur in this small Palustrine Emergent Wetland, which is threatened by

the invasive exotic Kikuyu Grass (*Pennisetum clandestinum*), and maintenance activities along the flood control levee. Elsewhere in Ventura County, it occurs in coastal habitats at McGrath State Beach, Mugu Lagoon, and Madalay Beach "County Park." Inland it is known from alkali seeps at Weldon Canyon, Sespe Hot Springs, and along the lower Sespe Creek in Ventura County (Magney, pers. observ., 1988).

Southern California Black Walnut (*Juglans californica* Wats., Juglandaceae). Southern California Black Walnut (Fig. 39) reaches its northern limit in Santa Barbara County, where it is rare. Although this species is not listed by an agency or society as rare, threatened, or endangered, it is declining in its native riparian habitat and is the characteristic component of California Walnut Woodland, a plant community listed by the NDDB (1989) as "probably threatened, needs more information". In the Ventura region, a limited occurrence of this community is reported at Casitas Springs (NDDB 1989) and others near Ojai (Smith 1976). It is well-represented in the interior of Ventura County such as at Sulfur Mountain (Magney, per. observ., 1988) and in the Santa Monica Mountains (J. R. Haller, UCSB, pers. observ., 1989). In the study area, several trees, which may be sterile hybrids (See: Appendix VIII), occur at Emma Wood State Beach on the western flood plain in the "Flood Plain Mixed Forest" type of Palustrine Forested Wetlands (See: Appendix II-Map of the Vegetation). This community has been described as "Southern Cottonwood Riparian Forests" by Holland (1986), although Southern California Black Walnut is not usually a component of it and is not usually located so close to the coast. Elsewhere in the study area, seedlings of Southern California Black Walnut or hybrids have been observed at the Hubbard Property along the river channel and on the eastern flood plain.

Southern California Locoweed. (*Astragalus trichopodus* (Nutt.) Gray ssp. *trichopodus*, Fabaceae). Southern California Locoweed has been identified as a special plant of local concern (SBBG 19982). It is rare in the study area, found mostly on the western flood plain north of the railroad and on the exposed riverbed, upriver from the Highway 101 bridges.

Nuttall's Chaparral Mallow. (*Malacothamnus fasciculatus* (Nutt.) Greene var. *nuttallii* (Abrams) Kearn., Malvaceae). Nuttall's Chaparral Mallow is an endemic to the south coast region of Ventura and Santa Barbara counties (SBBG

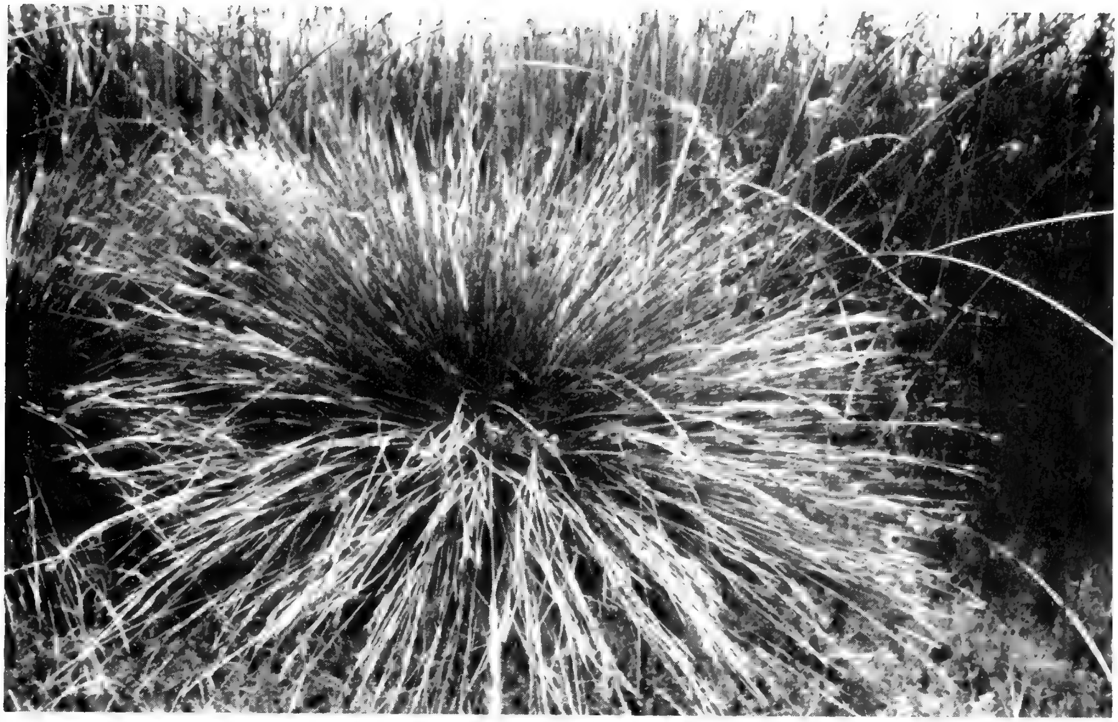

FIG. 38 SPINY RUSH (*Juncus acutus* var. *sphaerocarpus*).

FIG. 39 CALIFORNIA WALNUT (*Juglans californica*).

1988b). Its type locality (the place from which the type specimen was collected) is the Casitas Pass area. Nuttall's Chaparral Mallow was found in the Palustrine Forested Wetland adjacent to the Group Camp and Highway 101.

Yerba Mansa (*Anemopsis californica* Hook., Saururaceae). Yerba Mansa is an uncommon perennial herb that has been extirpated from many localities throughout its range. It is rare in the study area, occurring in only two sites: Second Mouth Estuary and River Mouth Swale. It is known from only a few isolated sites in Ventura County and has been identified as a plant species of local concern by the SBBG (1988b).

Plummer's Baccharis (*Baccharis plummerae* Gray, Asteraceae). Plummer's Baccharis is listed on CNPS List 4 (Smith and Berg 1988) as a rare California endemic that is not presently endangered. It generally grows in Coastal Sage Scrub, particularly on canyon slopes, along the coast of southern California from Los Angeles County (Santa Monica Mountains) northwestward to Santa Barbara County, and on Santa Cruz Island. In the study area, it is known from a single collection made by Pollard [weedy shore of estuary, 13 Oct 1965 (SBBG)]. The rich flora of the flood plain and exposed bed of the Ventura River is partly the result of the short-term occurrence of many species that are found more typically elsewhere in the watershed, but which have been washed downriver and subsequently established in the naturally disturbed riparian habitats along the lower Ventura River and Estuary. Although it was not observed during our study, Plummer's Baccharis could become re-established wherever conditions permit.

Seaside Calandrinia (*Calandrinia maritima* Nutt., Portulacaceae). Seaside Calandrinia is listed on CNPS List 4 and is considered to be endangered in a portion of its range (Smith and Berg 1988). It occurs on coastal bluffs from Santa Barbara County southward to Baja California, and on most Channel Islands (Munz 1974, C. Smith 1976). The only records from Ventura County are collections made by Pollard at "Taylor Ranch maritime bluffs" [about 1 mile west of Ventura River, 21 Apr 1965 (PCF)]. Pollard noted it was growing with another regionally rare plant, *Oligomeris linifolia* (Resedaceae), which also is known in Ventura County only from the Taylor Ranch bluffs [*Pollard* s.n. 1 Jun 1963, 23 Apr 1964, 10 Jun 1972 (PCF)].

Animals of Special Interest. Although this study did not include zoological resources at the Ventura River Mouth, a number of animals of special interest have been reported from the study area and vicinity. As considered herein, animals of special interest include those listed as endangered or threatened by USFWS (1989), or as (1) State listed endangered or threatened, (2) Federal or State candidates for listing, or (3) State species of special concern as listed in NDDB (1988).

Least Bell's Vireo is a Federal and State listed endangered bird last (?) observed nesting in the Ventura River Watershed upriver from our study area at Foster Park in 1909 (NDDB 1989). Vocalizations of a Least Bell's Vireo were heard in the riparian woodlands of the study area in the late 1970's (P. Lehman, UCSB, pers. comm., 20 Sep 1989). *California Least Tern*, a Federal and State listed endangered bird, has been observed in July and August of most years when this species visits the lagoon of the Ventura River Estuary during the post breeding period (P. Lehman, UCSB, pers. comm., 20 Sep 1989). *California Brown Pelican*, also a Federal and State listed endangered bird, is a frequent user of the Ventura River Estuary (M. H. Capelli, pers. observ., 1989). *Tidewater Goby* is a C2 Federal candidate fish and State species of special concern reported most recently from the Ventura River in 1984 (NDDB 1989) and in 1989 (C. C. Swift, LAM, pers. comm., 7 Sep 1989). Swift et al. (1989) state that, "Low vagility, restricted habitat, and short life span make populations vulnerable to elimination by human activities and many populations have disappeared, particularly in southern California and in the San Francisco Bay area." *Snowy Plover* is a C2 Federal candidate bird and State species of special concern that nested on the coastal sands in the area (Ventura Beach) until about 1945 (NDDB 1989). We observed several hundred individuals gathered on an exposed bar in the lower Ventura River Estuary in spring 1989. The site may be a seasonally important resting area for this migratory bird. *Belding's Savannah Sparrow* is a State listed endangered bird and C2 Federal candidate species restricted to salt marsh habitats in southern California. It has been observed in Seaside Wilderness Park (City of San Buenaventura 1982) on the eastern side of the Ventura River Estuary (S. L. Forsell, Ventura, pers. comm., 10 Aug 1976).

Eight additional species of interest are reported (e.g., NDDB 1989 and pers. observ.) for the area: *California Legless Lizard*, a regionally declining reptile

endemic to California and northwestern Baja California, was collected from dunes of the study area in 1979 (S. Sweet and S. Mackessy, 3 Feb 1979, UCSB Vertebrate Museum Nos. 8446-8449); *Yellow-breasted Chat*, a regionally declining bird and State species of special concern, has been reported from riparian woodlands of the study area (P. Lehman, UCSB, pers. comm., 1989); *White-faced Ibis*, a C2 Federal candidate bird and a State species of special concern, was recently observed in the Ventura River Estuary (M. H. Capelli, pers. observ., 1989); *Black-shouldered Kites* have been observed foraging in the study area, are declining in numbers regionally, and are fully protected by the State; *Osprey* is a California species of special concern that has been observed foraging in the Ventura River Estuary (M. H. Capelli pers. observ., 1989); *Tiger Beetles* [which are included in the State's list of special animals (NDDB 1988)] occurred at least historically on the dunes of the region and may be threatened; *Southwestern Pond Turtles*, a Federal candidate species and a California species of special concern, is declining in number regionally, but was observed in the study area in the Ventura River by our team; *Monarch Butterfly* winter roosts are important resting areas for this migratory insect [which is included in the State's list of special animals (NDDB 1988)], but are vulnerable to disturbances - a roost in trees at Seaside Wilderness Park was abandoned by Monarchs in the late 1960's when many of the trees began to die. We have recently observed small clusters of Monarchs in the Channel Margin Forest type of Palustrine Wetland on the Hubbard Property, and in Blue Gum (*Eucalyptus globulus*) groves north of the study area. Each of these species of special interest demonstrates additional significance or potential significance of the Ventura River Delta and the rich association of wildlife habitats in this small area.

Extirpated Species

Analysis of the catalogue of vascular plant species (Appendix VIII) reveals that many native plants have not been observed, reported, or collected since Pollard's field work dating from 1943-1972. Although in a few cases our inventory may not have located extant isolated individuals or populations of locally rare species, most examples are apparently of plants that presently do not occur in the study area. These species can be grouped by habitat, and their absence may demonstrate ecological changes that have taken place during the past few decades.

Ventura River Estuary. The Ventura River Estuary contains limited subtidal deepwater habitat when the mouth is open to tidal flushing, and extensive lagoonal habitat when the mouth is closed by a sand and cobble bar. At present, Spiral Ditch-grass (*Ruppia cirrhosa*) is the only submerged rooted aquatic plant that colonizes limited subtidal brackish habitats. Records of Fennel Pondweed (*Potamogeton pectinatus*) and Horned Pondweed (*Zannichellia palustris*) from the estuary in the 1940's suggest that perhaps a greater freshwater influence and/or higher water quality existed previously. Both of these have been observed in recent years in riverine wetlands upstream from the estuary.

River Mouth Swale. The River Mouth Swale is a small palustrine wetland on the east margin of the estuary immediately downriver from the railroad bridge (Fig. 6). It currently is habitat for several species of limited occurrence in the study area, including Spiny Rush (*Juncus acutus* ssp. *sphaerocarpus*), Yerba Mansa (*Anemopsis californicus*), and Marsh Cinquefoil (*Potentilla anserina*). Historically, other species have been reported or collected from a marsh at the river mouth. Examples of those species apparently extirpated from the study area include Santa Barbara Sedge (*Carex barbarae*), Golden Eardrops (*Dicentra chrysantha*), and Marsh Goldenrod (*Solidago confinis*). The River Mouth Swale was probably larger in the past, but has been reduced to its present small size as a result of construction of the flood control levee and other activities. In 1970, Pollard collected Salt Marsh Baccharis (*Baccharis douglasii*) at this site and noted, "Last sad relic of a once flourishing colony." Perhaps this statement is evidence that other species also have declined in numbers or have been extirpated.

Second Mouth Estuary. The estuarine wetland at the Second Mouth Estuary of the Ventura River is presently characterized by various salt marsh species. Periods of sedimentation and the current drought have resulted in seasonal rather than permanent flooding of most of the habitat. Species apparently extirpated from the wetland include Cluster Field-sedge (*Carex praegracilis*), Common Tule (*Scirpus acutus*), and Mexican Rush (*Juncus mexicanus*). The past occurrence of Common Tule [brackish pond west of river, *Pollard* s.n. 26 Jul 1963 (SBBG)] is botanical evidence that periods of prolonged flooding occurred here.

Southern Coastal Dunes. The coastal dune and strand habitats also have undergone floristic change. Bush Lupine (*Lupinus arboreus*) and California Sea Rocket (*Cakile edentula* var. *californica*) were collected in the 1940's, and California Sea Rocket was reported by Pollard until the 1960's. Increased access, landward erosion, and invasive exotic plants all may have contributed to the extirpation of these species and the reduced occurrence of others. Eastward of the study area along Pierpont Bay, other dune species such as Mock Heather (*Ericameria ericoides*) and Dune Sedge (*Carex pansa*) also have been extirpated or reduced in abundance or occurrence.

Sand flats of the dune swale may have received some of the more extensive impacts and subsequent species change. Agriculture, military development, and clearing for proposed residential development have altered topography and hydrology of these habitats. The Southern Pacific Railroad also has fragmented this area. One significant element of the flora now apparently missing is a grouping of annual spring species that probably grew on the seasonally moist or desiccating soils. Examples of these native annuals collected from the 1940's - 1960's include Pineapple Weed (*Amblyopappus pusillus*), Small Primrose (*Camissonia micrantha*), Cleveland's Cryptantha (*Cryptantha clevelandii* var. *florosa*), Shining Peppergrass (*Lepidium nitidum*), and Bigelow's Plantain (*Plantago bigelovii* ssp. *californica*), a regionally declining species. Additional field surveys might reveal limited occurrences of these species; however, dense perennial vegetation, encroachment of dunes and cobbles, and disturbance along access paths may not provide conditions suitable for the growth of these species. Sand Lettuce (*Dudleya caespitosa*), a succulent perennial confined to coastal habitats, also was collected from these sand flats in the 1960's, but was not observed during our study.

Flood Plain and Riverbed Habitats. Flood plain and exposed riverbed habitats also are sites for various native species potentially extirpated from the study area. Examples are Wild Licorice (*Glycyrrhiza lepidota* var. *glutinosa*), a herbaceous perennial characteristic of exposed riverbed and other wetland habitats; Willow Smartweed (*Persicaria lapathiflora*), a widespread native hydrophyte; Plummer's Baccharis (*Baccharis plummerae*), a regionally endemic shrub characteristic of shaded coastal slopes and riparian corridors; and three annuals including Bird's Beak (*Cordylanthus rigidus* ssp. *rigidus*), Jones' Cryptantha

(*Cryptantha muricata* var. *jonesii*), and Heermann's Tarweed (*Holocarpha heermannii*). Repeated natural disturbance from flooding and the subsequent dispersal of vegetative and reproductive plant material from upstream habitats of the Ventura River Watershed can result in repeated extirpation and introduction of both native and exotic species. The above taxa are probably representative of this phenomenon.

Information on reduction or extirpation of species is valuable as a tool to help guide habitat restoration efforts. Improvement in water quality in the estuary during impounded conditions, reduction of access to dunes, and excavation and revegetation of the Second Mouth Estuary wetland could result in the recovery of habitats and the return of extirpated species. Historical plant records also can be used to assist with the species composition of revegetation plans. Future monitoring efforts should focus, among other topics, on "target" species (such as those extirpated, sensitive, or of limited occurrence) that might be useful indicators of the quality of habitats and of the overall study area.

Invasive Exotic Weeds

McClintock (1985) states that, "Weeds are plants disseminated through the actions of man, sometimes intentionally but more often unintentionally." She noted that at least 16 species of exotic (i.e., nonnative) plants were established in California during Spanish colonization (1769-1824), but by the 1960's nearly 1000 species of introduced plants were documented for the state. McClintock (1985) grouped the introduction of weeds into three categories: 1) those introduced unintentionally, for example, through agricultural practices; 2) those introduced intentionally for use as ornamentals; and 3) those introduced intentionally as food plants. Once introduced, weeds become "naturalized" under favorable conditions and are established as a part of the regional flora. She also categorized those weeds that have "escaped" cultivation: Group One - benign weeds that remain within urban areas; Group Two - minor weeds that remain in disturbed areas; and Group Three - major weeds that aggressively invade native vegetation. Our study area at the Ventura River Delta and vicinity includes examples of each category. Although we have determined that exotics are about 47% of the flora of the study area (See: Botanical Resources - Flora), most weeds are not particularly invasive and their presence or invasiveness does not threaten native vegetation or species.

At least 17 species, however, are presently or potentially threatening native botanical resources at Emma Wood State Beach and Seaside Wilderness Park. Some of these species were mapped (Appendix IV) and are discussed below, particularly those plants that pose the greatest threat or those most difficult to control. Refer to Management Opportunities for a prioritized plan to eliminate or control the invasive species.

Castor Bean [*Ricinus communis*, Euphorbiaceae] Castor Bean (Fig. 40) can be an annual or a tree to 40 feet (12 meters) and probably is native to tropical Africa, but is now widely naturalized in tropical and warm regions (L. H. Bailey Hortorium 1976). It grows frequently as an "escape" in waste places (Munz 1974) and is considered by McClintock (1985a) to be a minor weed. In the study area, however, it is established on the flood plain and exposed riverbed and occurs as an occasionally common small tree or herbaceous weed. Recently, it has established in abundance along disturbed margins of new access roads at Emma Wood State Beach - Ventura River Group Camp. A large colony is also found along the southern border of the railroad berm in Seaside Wilderness Park. Under these conditions it poses a threat to native vegetation. It clearly responds to disturbance and germinates in great numbers, suggesting that a widespread and abundant seed bank probably exits in flood plain habitats.

Sweet Fennel [*Foeniculum vulgare*, Apiaceae]. Sweet Fennel (Fig. 41) is an herbaceous perennial native to Europe. In the Santa Barbara and Ventura regions, it can form dense, monospecific stands in disturbed areas and can be an invasive weed in coastal grasslands and scrublands. In the study area, it is common in the disturbed grove of trees at Seaside Wilderness Park and is occasional in exposed riverbed and flood plain habitats at Emma Wood State Beach and the Hubbard Property. The artificially and naturally disturbed aspects of these habitats, resulting from agriculture and from erosion and deposition during occasional or rare flood conditions, produce substrates that favor weeds such as this. Sweet Fennel produces abundant seeds that germinate readily in the disturbed soils.

German Ivy [*Senecio mikanoides*, Asteraceae]. German Ivy (Fig. 42) is a twinning perennial native to southern Africa. It is naturalized in canyons and riparian corridors in central and southern California (Munz 1974) and has been

FIG. 40. CASTOR BEAN *(Ricinus communis).*

FIG. 41. SWEET FENNEL *(Foeniculum vulgare).*

reported from California since the late 19th century (McClintock 1985a). All populations of this species in California come from a single clone, and because the species is reproductively self-incompatible it produces no seeds and spreads only vegetatively (McClintock 1985a). German Ivy climbs over native vegetation, particularly within Palustrine Forested Wetland on flood plains and in canyons, reducing the viability of native plants. In the study area it is particularly invasive on the western flood plain of the Ventura River in Emma Wood State Beach.

Giant Reed [*Arundo donax*, Poaceae]. Giant Reed (Fig. 43) is a perennial grass that grows in large "clumps" with stems to about 18 feet (6 meters) tall and has been planted to help control erosion (L. H. Bailey Hortorium 1976). It is native to the Mediterranean region and has naturalized in California in seeps, ditches, and river banks and beds. Giant Reed has been planted as an ornamental in the upper watershed of the Ventura River (e.g., Matilija Canyon) and has spread downstream during major flood events. It is found in large stands on sand and gravel bars of the main river channel as well as in the western flood plain and in the higher exposed bars and margins of the lower Ventura River Estuary. In a card file for specimens collected in the Ventura River Basin, Pollard recorded in 1945 that, "this reed is well established for many miles along the river and its tributary streams, and near the river's mouth may be found now and then growing in beach sand within a few yards of the surf." Giant Reed has become increasingly invasive in coastal riparian habitats in southern California and is perhaps the invasive exotic plant that most threatens the displacement of native vegetation in the study area. It reproduces vegetatively in California by aquatic dispersal of roots and stems.

Hottentot Fig [*Carpobrotus edulis*, Aizoaceae]. This naturalized "ice plant" is a trailing succulent shrub native to the Cape Province of South Africa. It has been planted widely along highways by CALTRANS and on dunes by the California Conservation Corps for dune "stabilization." In California, it reproduces vegetatively and by seed and is a serious threat to native vegetation on dunes, along the margins of estuaries, and in some types of coastal maritime chaparral (McClintock 1985a; Smith 1976, Schmalzer and Hinkle 1987). Its seeds can be dispersed by small mammals (C. D'Antonio, UCSB, pers. comm. 1989) and germinates readily after fire or disturbance of substrates. A related plant, Sea Fig (*Carpobrotus aequilaterus*), occurs in similar situations but is less invasive. Hybrids

FIG. 42. GERMAN IVY *(Senecio mikanioides)*.

FIG. 43. GIANT REED *(Arundo donax)*.

FIG. 44. HOTTENTOT FIG *(Carpobrotus edulis)*.

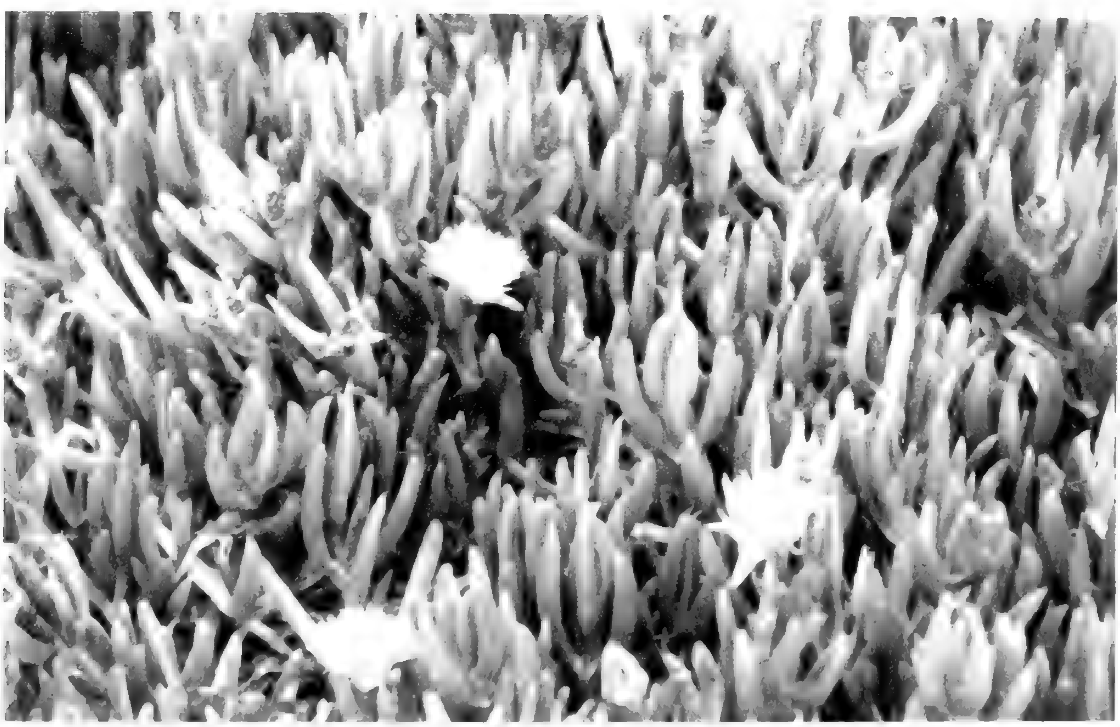

FIG. 45. HOTTENTOT FIG *(Carpobrotus edulis)*.

between these two species are common. In the study area (Figs. 44, 45), Hottentot Fig is more common than Sea Fig and has established on dunes, beach cobble, and terrace deposits at the western limit of the study area. It is a serious threat to native dune vegetation.

Kikuyu Grass [*Pennisetum clandestinum*, Poaceae]. Kikuyu Grass (Fig. 46) is a stoloniferous and rhizomatous grass native to Africa, and in southern California is "...easily becoming a dangerous weed in orchards and gardens" (Munz 1974). Kikuyu Grass also can be extremely invasive in riparian areas where it can completely cover substrates and vegetation, eliminating all native herbaceous species. It is a state-listed noxious weed (Barbe 1983). Baker (1985) has stated that this species"... is both noxious and a widespread colonizer because its wide environmental tolerance is backed by vigorous vegetative reproduction and probably by the excretion of soluble chemicals that can depress the growth of potential competitors." It is commonly used as a lawn grass in frost-free areas of California. In the study area, Kikuyu Grass poses the biggest threat at the River Mouth Swale on the eastern margin of the Ventura River Estuary in Seaside Wilderness Park. Here it has invaded native wetland vegetation and threatens to eliminate habitats for Spiny Rush, a plant species of special interest (See: Botanical Resources - Species of Special Interest).

Myoporum [*Myoporum laetum*, Myoporaceae]. Myoporum (Fig. 47) is a vigorous and fast-growing shrub or small tree to about 15 feet (5 meters) tall that is native to New Zealand (L. H. Bailey Hortorium 1976). It is cultivated as an ornamental tree or hedge in California and naturalizes from seed in coastal southern California, particularly in riparian corridors and on the margins of coastal wetlands such as estuaries. In the study area, shrub-sized plants have established at Seaside Wilderness Park and occasionally in Palustrine Forested Wetlands in the vicinity of the lower Ventura River Estuary.

Pampas Grass [*Cortaderia jubata*, Poaceae]. Pampas Grass (Fig. 48) is a perennial clump-forming grass native from Ecuador and Peru to Argentina (L. H. Bailey Hortorium 1976). It was introduced into California for landscaping (Kerbavaz 1985). A related species (*Cortaderia selloana*) was introduced into California in the late 19th Century and was cultivated for its showy plumes. Unlike *C. selloana*, *C. jubata* has become a serious invasive weed in moist soils along

FIG. 46. KIKUYU GRASS *(Pennisetum clandestinum)*.

FIG. 47. MYOPORUM *(Myoporum laetum)*.

coastal California. Kerbavaz (1985) states that it reproduces apomictically (seeds forming without fertilization) and that each plume can produce thousands of wind-distributed seeds. In the study area, a few plants occur on the margin of estuarine wetlands in the vicinity of the Second Mouth Estuary of the Ventura River at Emma Wood State Beach.

Tamarisk or **Salt Cedar** [*Tamarix ramosissima*, Tamaricaceae]. Several species of Tamarisk are aggressive invasive exotic trees in the southwestern United States, where they have displaced native riparian trees to form the dominant vegetation in some areas such as the Gila River in Arizona (Neill 1985). These plants are native to the Mediterranean region and Asia, and were introduced as ornamental, shade, or windbreak trees or to stabilize banks (Neill 1985). They are less invasive in coastal California; in the study area, only a few occur in the estuarine wetlands and the Second Mouth Estuary (Fig. 49) and in exposed riverbed habitats along the Ventura River. Munz (1974) lists *T. africana* for the Ventura River Mouth, his only record of the species in southern California. We have collected only *T. ramosissima* (See: Baum 1978) from desiccated Estuarine Emergent Wetland at the Second Mouth Estuary and in exposed cobble beds of the Ventura River. Other species such as *T. aphylla* (L.) Karst., *T. chinensis* Loureiro, and *T. parviflora* DC. also occur in southern California.

<u>**Other Invasive Exotic Weeds**</u>. Many other weedy species occur in the study area, some of which are potentially invasive here or are already problematic. **Bermuda Grass** (*Cynodon dactylon*) is a perennial grass that can dominate some soils and presently occurs in various ruderal, exposed riverbed, and flood plain habitats. It is a state-listed noxious weed (Barbe 1983). **Common Ice Plant** (*Mesembryanthemum crystallinum*) from southern Africa can colonize coastal soils and can increase soil salinities when the plants die each year and then deposit salt that was stored in the plant. It occurs in the dunes at Emma Wood State Beach. **Hoary Cress** (*Cardaria draba*) is a perennial rhizomatous herb that has colonized portions of the dune swale habitat. It is a state-listed noxious weed. **Italian Thistle** (*Carduus pycnocephalus*) is an annual thistle that can form dense stands in disturbed soils. It has colonized portions of some flood plain habitats and is a state-listed noxious weed. **New Zealand Spinach** (*Tetragonia tetragonioides*) is an annual in the ice plant family that has colonized extensive areas of dune swale

FIG. 48 PAMPAS GRASS *(Cortaderia jubata).*

FIG. 49. TAMARISK *(Tamarix ramosissima).*

habitat and at the Seaside Wilderness Park where it grows over and reduces the vigor of native vegetation.

Spanish Broom (*Spartium junceum*) is one of several European shrubby legumes referred to as "brooms" that have become invasive in California and can form dense stands and may spread into areas of native plants (McClintock 1985b). Smith (1976) reports that Spanish Broom is occasionally in cultivation in the Santa Barbara region and is commonly spontaneous near parent plants in coastal areas. He gives as an example the Ventura River bed from southwest of Ojai to Wheeler Gorge and above "... where it was first sowed for erosion control." In the study area, Spanish Broom is rare in exposed riverbed cobble on the Hubbard Property, where it probably established from seed washed down river from other naturalized plants. **Tree Tobacco** (*Nicotiana glauca*) from South America is a shrub or small tree found occasionally in disturbed areas, particularly on stream and river banks; in exposed beds, and along berms in estuaries. Tree Tobacco is scattered throughout the study area including flood plain habitats and dunes. **Uruguay Water Primrose** (*Ludwigia uruguayensis*), native from southeastern North America to Argentina, is a rooted aquatic herb that also can extend over water and float on the surface. It is abundant along the Ventura River near Main Street Bridge and dominates the margins and surface of the low-flow perennial channel, where it excludes native species in the Riverine Emergent Wetland. **Poison Hemlock** (*Conium maculatum*), native to Europe, is an annual species that can form dense, monospecific stands in disturbed upland areas such as abandoned agricultural sites and soil piles in the vicinity of the Group Camp. Colonization of some disturbed riparian habitats by native plants may be prevented if invasive exotic weeds such as Poison Hemlock dominate the early stages of vegetational succession in these areas.

These additional weedy species also should be incorporated into the plan to eliminate or control the invasive species (See: Management Opportunities).

REGULATORY AUTHORITIES AND POLICIES

The Emma Wood State Beach - Ventura River Group Camp and the Ventura River Estuary lie within the jurisdictional boundaries of the City of San Buenaventura. Although the California Department of Parks and Recreation has the responsibility for developing programs and facilities within the State Park System, the City of San Buenaventura and County of Ventura have the primary responsibility of regulating land use and developments within and surrounding the study area. There are a number of other local, State and Federal entities that have jurisdiction over various aspects of development and other activities. Because effective management and protection of the botanical and other natural resources of the study area depend upon the coordination of all the responsible regulatory agencies, we have provided a brief overview of the most relevant regulatory authorities, and a summary of their major areas of responsibility and basic policies.

Local

City of San Buenaventura. The study area lies entirely within the City of San Buenaventura. The City has the principal responsibility of regulating development on the land side portion of the study area including the lower Ventura River Estuary through its certified Local Coastal Program. However, this area also lies within the appeal jurisdiction of the California Coastal Commission, and developments approved by the City may be appealed to the Commission for review for consistency with the City's Local Coastal Program. Portions of the study area seaward of the mean high tide line are within the Coastal Commission's original permit jurisdiction.

The City of San Buenaventura Local Coastal Program (1981) maps the sensitive habitat areas of the lower Ventura River, including the study area, and contains a number of policies, programs, and development standards that apply specifically to the lower Ventura River and the adjacent flood plain. They include the following:

> *RECREATION: Because of the smaller size of the Hubbard property and constraints to agricultural production, recreational uses may be permitted on this site. These uses may be permitted provided that adequate landscaping,*

flood plain mitigation measures, and measures to protect the adjacent sensitive habitat area are incorporated. No diking or levee facilities shall be permitted.

PARKS: Emma Wood State Beach Park General Development and Resource Management Plan, as adopted by the State Parks Commission, shall be incorporated into the City's Local Coastal Program and development of the Park shall proceed in accordance with that Plan. Development of the day-use and overnight camping facility should incorporate measures to minimize flood hazards. Development within Hobo Jungle shall be limited to nature study purposes and passive recreation. Nature study and interpretive opportunities in Hobo Jungle shall be coordinated with facilities in Emma Wood State Beach. Should development and management of Hobo Jungle by the City be infeasible, the City should coordinate with the State Department of Parks and Recreation regarding development, management, and future ownership.

SENSITIVE HABITAT: The intent of the Sensitive Habitat designation is to protect habitats which support the vegetation and animal species in the area from urban disturbances. All development in the area surrounding the Ventura River sensitive habitat area shall be reviewed to mitigate any potential impacts on the area. Development within the Ventura River sensitive habitat area shall be subject to the following criteria:

1) *The area shall be retained in as natural a state as possible. Development proposals shall be designed to enhance and restore the natural habitat values of the area whenever possible. In Hobo Jungle, the effort should include methods of protecting and restoring the existing grove of Monterey Cypress trees or replacing these trees with native species appropriate to the location and site conditions.*

2) *Activities shall be limited to passive recreation, nature study, and educational and scientific research.*

3) *Development shall be limited to facilities necessary to the functioning of the allowable activities (e.g., trails, blinds); no buildings shall be allowed.*

4) *Access to the area shall be limited to foot traffic and non-motorized vehicles, except for maintenance vehicles. Fencing, signage and other measures shall be used, where appropriate, to inform the public of the sensitive habitat and the need for restricted access.*

5) *Any development surrounding the sensitive habitat area shall be suitably set back and buffered from the habitat area. Definition of the habitat areas identified, located and mapped shall be those found in the Sensitive Habitat section herein. Any development surrounding the Sensitive Habitat areas shall be set back and buffered from the habitat area. This buffer shall extend at least 100 feet in depth from the sensitive habitat overlay boundary shown on Map 12. Because the sensitive habitat overlay boundary is not the result of precise mapping, the precise location of the furthest extent of sensitive habitat and riparian vegetation from which the minimum 100-foot buffer*

would be measured shall be established prior to the approval of any permits for development proposals adjacent to habitat areas, consistent with recommendations from the State of California Department of Fish and Game. In no case shall development (including agricultural development) be allowed to encroach closer than the current location of the western edge of the access road north of Main Street, as shown in Map 12. On the Emma Wood State Beach property, the buffer area shall be coterminous with the western edge of the area identified as "nature study area" on Map 1 of the LCP as part of the Emma Wood State Beach General Development Plan and Resource Management Plan adopted by the California Parks Commission in July 1976 in response to Coastal Permit 25-78, and incorporated into the City's LCP as Exhibit C.

Uses within the buffer area shall be limited to agricultural activities, recreation, nature study, and educational and scientific research. No structures shall be permitted. Access to the beach from any recreational development on the Hubbard Property shall be obtained via Emma Wood State Beach. Fences and signs to restrict access into the buffer and sensitive habitat areas will be required for any recreational development on the Hubbard Property.

6) *In order to protect the anadromous fish run in the Ventura River and the biological productivity of the Ventura River lagoons and sensitive habitats, the City shall consider effects of all of its actions affecting the Ventura River in order to assure the maintenance of adequate flows within the river to maintain in-stream flows as well as stream productivity within the coastal zone. Developments shall not adversely impact the water supply groundwater levels, or water quality of the river within the coastal zone. The potential impacts shall be evaluated and mitigated as required in conjunction with environmental review procedures for a particular project, in a manner not inconsistent with any determination of the State Water Resources Control Board.*

7) *Stream alterations will be permitted for the purpose of exercising water rights to irrigate agricultural lands. Such alterations shall be guided by and incorporate the following principles and mitigation measures:*

   a) *Stream alterations shall minimize the disruption of riparian vegetation.*

   b) *Stream alterations shall be conducted in a manner which will minimize downstream sedimentation through the use of such techniques as at-grade culverts for repeated stream crossings; silt curtains; silt catchment basins; use of indigenous construction materials.*

c) *Stream alterations made for the purposes of diverting flow for water shall utilize the existing low flow channels whenever possible.*

d) *All flows from stream diversions returned to the stream shall be routed back into the original low flow channel; where there are multiple or braided channels downstream of the diversion, the channel possessing the greatest wildlife value shall be used, as determined in consultation with the State Department of Fish and Game.*

e) *All water diversion intakes shall be screened with a minimum mesh of one-fourth inch to prevent the induction of fish.*

f) *Return or excess flows shall be routed back into the stream in such a manner as to provide for the unimpeded passage of fishes, both upstream and downstream of the diversion. Diversions utilizing a gravel training dike shall incorporate an inclined chute of indigenous rock material. In no case shall a suspended outlet pipe or culvert be used as a spillway.*

FLOOD PLAIN AREA: The intent of the Flood Plain designation is to minimize the risk to life and property in areas subject to flooding. Until a flood plain ordinance and management program is developed and adopted by the City, no development, including active recreational uses (e.g., camping), or new buildings associated with agricultural uses, shall be allowed. These policies shall not apply to the Hubbard Property, Parcel No. 60-320-28. Refer to the Hazards section for policies relevant to this property.

This does not imply that such uses will be allowed upon adoption of a flood plain ordinance. Rather, it is intended that uses allowed within the 100-year flood plain shall be compatible with both a flood plain ordinance and the underlying land use designation.

ENERGY FACILITIES: The Ventura River basin area contains a former saltwater pump station, oil pipelines, and undeveloped oil drilling sites. Due to the proximity of these facilities to recreation and sensitive habitat areas, no new energy or industrial facilities, except for pipelines, shall be located between Highway 101 and the shoreline. However, no such facilities shall be allowed within a Sensitive Habitat area. Oil pipelines will be allowed to cross the portion of Ventura River located within the coastal zone even though it will pass through a sensitive habitat area. Mitigating measures, such as shut-off valves, should be incorporated to provide environmental protection.

In addition to the provisions of the Local Coastal Program, developments and activities within the study area are also determined in part by other City Departments. The City Parks and Recreation Department manages the Seaside Wilderness Park, and runs a docent and outreach program providing interpretive

tours of the area. The City Police Department has responsibility for responding to emergency calls and enforcing City ordinances involving such activities as vehicles on the beach and the discharge of firearms.

County of Ventura. The study area is surrounded to the north and west by unincorporated lands subject to the jurisdiction of the County of Ventura (excluding those in the National Forest portion of the Ventura River Watershed). The Ventura County Flood Control District has responsibility for flood control within the Ventura River. The Flood Control District has a flood easement over the main channel of the Ventura River, including portions of the west flood plain, as depicted in Figure 5. The County Flood Control District also maintains, under contract, the U.S. Army Corps of Engineers' levee on the east bank of the Ventura River. The maintenance of these facilities is governed by the terms of a maintenance manual, which requires that the facility be able to meet the project design standards (U.S. Army Corps of Engineers 1949). A Watercourse Permit (Watercourse Ordinance FC-18) is required from the Ventura County Flood Control District for any construction, or development within the Ventura River flood easement. Watercourse permits are required principally to ensure that developments will not be subject to flood damage, or cause flood damage to existing public or private structures. Ventura County (1981) has also adopted as part of its 208 Area Wide Water Quality Management Plan a set of standards for conducting emergency flood control work within sensitive habitat areas of the channels. Adopted "Best Management Flood Control Practices" include:

FLOOD CONTROL

A. Keep Work in Streams to an Absolute Minimum.

Description: Doing the minimum work necessary is, in most cases, something that results from budgetary constraints and good sense. It is, however, the most environmentally sound management practice that can be pursued and is, therefore, worthy of comment here.

B. Where Flood Control Activities are Necessary to Maintain a Portion of the Stream in its Natural Condition, Isolate it from the Required Work.

Description: There are a number of ways in which this management practice can be achieved. Where work must be done in an area where one main channel exists, it may be possible to leave one side of the channel intact. It may be possible to selectively leave portions of the stream vegetation on both sides. In either case, it is essential to maintain the main stream flow adjacent to or through those riparian areas left intact.

Where it is necessary to work in a riparian area that contains more than one channel, it is desirable to leave at least one channel intact with a "buffer zone" of riparian vegetation of at least 50 feet on each side of the flowing water. This may require the insertion of a "soft plug" at the upstream terminus of the channels. The "soft plug" should be engineered to maintain low flows in the channel left intact, but allow larger storm flows to wash out the plug.

Where there exists a choice of preserving one of several channels, the most environmentally sound choice involves consideration of several factors. These factors include: Proximity to other terrestrial habitats, time of year, existence of unique aquatic resources such as pools, riffle and spawning beds, etc. It is desirable to seek the advice of qualified experts in considering these factors such as the California Department of Fish & Game and the U.S. Fish and Wildlife Service.

C. Where The Earth Must Be Physically Moved, Store the Top Two to Three Feet of Material and Redistribute After the Work is Completed.

Description: This practice involves the skimming off of <u>observable</u> nutrient laden soils, stockpiling them and then redistributing them over finished work areas. This is a desirable practice, particularly near new stream channels. It is extremely important, however, that stockpiled material not be pushed into flowing water. This practice should be employed in rocky sandy stream areas where nutrients (in clay and silts) are scarce. This practice need not be utilized where stream gradients and adjacent soil profiles provide a rich abundance of soil nutrients.

D. Where Earth Work is Required, Restore Natural Features Such as Meanders, Pools, Turbulence and Braiding.

Description: The primary aim of this management practice is not to replace visual aesthetics (although that is a legitimate goal). Rather, the purpose here is to assist nature in bringing the disturbed riparian environment back to its desired ecological balance. The manner in which these natural features are restored depends on the previous "natural" circumstance. In a large river system such as the Santa Clara System, it may be appropriate to cut new channels, encourage meander and build pool areas with heavy equipment. In a smaller system such as the Ventura system, it may be appropriate in some areas to create small falls and pools by hand.

In utilizing this management practice, there are no pre-set plans which can be applied to a specific situation. Each stream area will likely have a unique combination of stream elements. A degree of subjective judgement must be used in deciding how to restore natural stream elements. While there is not necessarily a "right" solution, there are "better" solutions. Obviously, the "better" solution is going to result from careful evaluation of the natural stream elements and knowledge of the probable consequences of flood control work. In most situations, the evaluation should be done in the field with input from a qualified maintenance supervisor and a qualified biologist. The primary factors to be covered in the evaluation are found in Appendix "D", "Work Sheet for Field Evaluations".

Once this evaluation is made, initial decisions can be made as to which natural features are to be restored. Some decisions must be made as work progresses

and will require a degree of creativity on the part of the maintenance supervisor. Even though each situation will be unique, there are certain benchmark criteria which can be useful in making field decisions.

BENCHMARK CRITERIA FOR RESTORING NATURAL STREAM FEATURES

1. *Place a one to two foot fall at approximately 1/8 mile intervals.*

2. *Create flat depressions for ponds. These should be in ratio with the adjacent stream with approximately 3:1 (i.e., a 3 feet wide pool would be in the proper proportion to a 1 foot wide stream).*

3: *Construct potential stream channels that will meander, rather than flow in a straight line where work exceeds 1/8 mile in length.*

4. *In all areas except ponds, leave bottoms rough and irregular rather than smooth.*

5. *Use existing elements, such as large rocks over 4 feet in diameter and existing falls as much as possible.*

6. *Use hand methods in creating smaller falls and pools.*

E. *Install Culverts, Silt Curtains and Other Devices that Control Turbidity Where Work Must be Conducted in or Adjacent to Stream Water.*

The effects of turbidity on aquatic ecosystems has been discussed. The previous discussion of other best management practices has stressed the need to avoid work in flowing water unless absolutely necessary. If flood control activities are necessary in stream waters, there are a number of ways in which habitat destruction and stream turbidity can be minimized. The following general criteria should be used in applying these management techniques.

a) *Where equipment must cross flowing water on more than one occasion, install a pipe culvert of sufficient capacity to handle existing flows. The pipe invert should be at or slightly below the existing stream bottom at both ends. Use clean sand and rock to cover the pipe and avoid the use of silts and clays.*

b) *Where equipment must work adjacent to a stream or pond, establish a barrier to keep equipment and soil from getting in the water. The best barrier is distance and no barrier is necessary if work is in excess of 20 feet from the edge of water. The next best barrier is native vegetation and no additional barrier is needed if a 20 feet wide strip of vegetation greater than 6 feet high remains between the water and the work.*

   Where work must be conducted closer than 20 feet, a temporary barrier of large rock and sand 2 to 4 feet high can be constructed. In unique circumstances, a temporary barrier of wood or metal may be used.

c) *Where work must be conducted directly in water and flows cannot be diverted, the work should be completed as quickly as possible. In larger water bodies, and where flow velocities permit, plastic silt curtains*

should be placed down from the work. In faster flowing water, a series of small falls (2'-3') can be constructed of larger rock to slow water and encourage the deposition of silts and clays.

The application of these "Best Management Flood Control Practices" upstream beyond the study area, as well as in the study area, is essential because disturbances resulting from flood control activities (e.g., turbidity and siltation) are often transported downstream.

The Ventura County Planning Department is responsible for developing standards for development in the Ventura River Watershed (excluding the Los Padres National Forest). The County General Plan recognizes the value of the natural resources of the Ventura River corridor, and contains a number of policies and programs providing for the protection of these resources. In addition, the County has adopted special wetland protection policies that require maximum setbacks from all wetland habitats (Ventura County 1989). These provide the following:

POLICY 1.5.2.3.

Discretionary development that is proposed to be located within 300 *feet of a marsh, small wash, intermittent lake, intermittent stream, spring, or perennial stream as identified on the latest USGS 7 1/2 minute quad map shall be evaluated by a qualified biologist, approved by the County, for potential impacts on wetland habitats. Discretionary development that would have a significant impact on significant wetland habitats shall be* prohibited*, unless mitigation measures are adopted that would reduce the impact to a less than significant level, or for land designated "Urban" or "Existing Community", a statement of overriding considerations is adopted by the decision-making body.*

POLICY 1.5.2.4.

Discretionary development shall be sited a minimum of 100 *feet from wetland habitats to mitigate the potential impacts on said habitats. Buffer areas may be increased or decreased upon evaluation and recommendation by a qualified biologist and approval by the decision-making body. Factors to be used in determining adjustment of the* 100 *foot buffer include soil type, slope stability, drainage patterns, presence or absence of endangered, threatened or rare plants or animals, and compatibility of the proposed development with the wildlife use of the wetland habitat area. The requirement of a buffer (setback) shall not preclude the use of replacement as a mitigation when there is no other feasible alternative to allowing a permitted use, and if the replacement results in no net loss of wetland habitat. Such replacement shall be "in kind" (i.e., same type and acreage), and provide wetland habitat of comparable biological value. On-site replacement shall be preferred wherever possible. The replacement plan shall be developed in consultation with California Department of Fish and Game.*

PROGRAM 1.5.3.4

The Planning Division shall prepare a program proposal, for Board of Supervisors consideration, to map significant wetland habitat areas and amend the General Plan and Zoning Ordinance in order to establish a Biological Resource Protection Overlay designation/zone which would require all development in said overlay areas to be evaluated for impacts on significant wetland habitat areas.

Local Agency Formation Commission. The Local Agency Formation Commission (LAFCO) has responsibility for general long range planning, and approval of annexations of County lands to, among other cities, the City of San Buenaventura. LAFCO is governed by a five member Board composed of elected representatives from the County and cities of Ventura County. LAFCO decisions regarding annexations, spheres of influence, and special district boundaries establish the basic patterns of development within the County. Decisions are based upon a set of general policies established by its Board members, and by consideration of other relevant local and regional plans such as the County and City General Plans and the relevant Local Coastal Programs.

Ventura Regional Sanitation District. Ventura Regional Sanitation District is responsible for coordinating the county's handling of solid wastes, and operates several land fills. The District is governed by a Board of Directors composed of the Chairman of the Board of Supervisors and a member of the governing body of each City and District engaged in waste management. The District area of responsibility covers the entire County, including the 3 miles off-shore. In addition to operating several sanitary land fills, the District is also engaged in long range planning for waste recycling. The District is currently planning the construction of a major solid waste land fill in Cañada Larga Canyon, a tributary of the Ventura River, which could impact water quality in the lower Ventura River.

State

California Department of Fish and Game. The California Department of Fish and Game has primary responsibility for regulating the taking of all species of animals and enforcement of the Department's program regarding rare and/or endangered species of plants and animals. The Department also administers a Wildlife and Marine Refuge Program that affords special protection to representative or outstanding examples of native California habitats. The

Department does not have direct regulatory authority over developments, although it does regularly provide comments on projects through the California Environmental Quality Act (CEQA) process. Further, the Department does have a measure of regulatory authority through its Stream and Lake Alteration Agreement process under Sections 1600-1605 of the California Fish and Game Code. These sections require that all persons, (private or public) enter into an agreement with the Department prior to the alteration of any stream or watercourse depicted as a blueline channel on the largest scale U.S.G.S. topographic map. This process allows the Department to impose conditions which will mitigate impacts of a project on aquatic and other natural resources.

Regional Water Quality Control Board. The Regional Water Quality Control Board - Los Angeles Region (RWQCB) is governed by a nine member Board which is appointed by the Governor and the California Legislature. The RWQCB has the primary responsibility for setting discharge requirements for both point and non-point discharges. The RWQCB has been authorized to act on behalf of the Environmental Protection Agency in the issuance of National Pollution Discharge Elimination System (NPDES) discharge permits for point discharges. The Board also issues non-point discharge permits under the authority of the Porter Calogne Act. The discharge requirements established by the Board are intended to protect recognized beneficial uses of the receiving waters as identified in the *Water Quality Control Plan Report Santa Clara River Basin (4A)*. Ocean Discharges are evaluated for consistency with the California Ocean Plan. The RWQCB has recognized many beneficial uses of the lower Ventura River. These include contact and non-contact water recreation, agricultural and industrial service supplies, groundwater recharge, freshwater replenishment, wildlife and warm and cold freshwater habitats, fish spawning and migration, and within the tidal prism, marine and saline water habitats, commercial ocean and sport fishing, and shellfish harvesting (California Regional Water Quality Control Board, Los Angeles Region 1975, 1978).

State Water Resources Control Board. The State Water Resources Control Board (SWRCB) is governed by a five member Board appointed by the Governor and the California Legislature. The Board has the primary responsibility for permitting the diversion of water from surface streams, and in some cases underground waters. The Board also serves as an appeal Board for waste

discharge permits issued by the Regional Water Quality Control Boards. The policy and permit decisions are based upon the Federal Clean Water Act, the California Water Code, and relevant sections of the Fish and Game Code as well as on provisions of the California Constitution. In addition to its regulatory functions, the State Board also engages in long range water planning, and administers a grant program to support local and regional treatment of liquid wastes (e.g., Federal Clean Water Assessment Program, and the Safe Drinking Water and Toxic Enforcement Act of 1986).

State Lands Commission. The State Lands Commission is governed by a three member Board elected and appointed by the Governor. The State Lands Commission has the primary responsibility for managing state tide and trust lands. The State Lands Commission issues permits and makes determinations regarding the location of the mean high tide line, and the extent of historic public trust lands. Its decisions are based upon basic policies intended to protect the public's interest in state owned lands, to ensure the right of public access, and the preservation of natural resources. The State Lands Commission also oversees the leasing of state tidelands for oil and gas developments, as well as other natural resources development, and carries out various programs such as the removal of artificial hazards and debris from the intertidal zone, and other state tidelands.

Division of Mines and Geology. The Division of Mines and Geology is responsible for inventorying and developing long range plans for the conservation and utilization of the mineral resources of the state. It also reviews and approves mining reclamations plans for operations such as sand and gravel extraction. In addition, it administers grants to local and regional agencies doing planning for mineral extraction and recovery. The Division of Mines and Geology is responsible for reviewing and approving the mining reclamation plan for the Southern Pacific Milling sand and gravel mining operations on the Ventura River immediately upstream of the study area.

California Coastal Commission. The Coastal Commission is governed by a 12 member Commission appointed by the Governor and the California Legislature. The Commission exercises the primary land use regulatory authority within the Coastal Zone. The Commission certifies Local Coastal Programs which

authorize local governments to issue Coastal Development permits, and acts as an appeal body for developments appealable to the Commission. The Commission also exercises original permit jurisdiction on state tideland, or public trust lands, and all lands seaward of the mean high tide lines out to three miles. The Commission also has the responsibility to review federal projects through the federal consistency review authority granted by the Department of Commerce. In addition to its regulatory responsibilities, the Commission also engages in long range planning for the protection and restoration of coastal resources, including wetlands, beaches, and other coastal habitats. The entire study area above the mean high tide line falls within the Commission's appeal jurisdiction. The standard of review for developments appealed to the Commission is consistency with the applicable provisions of the San Buenaventura Local Coastal Program. The portion of the study area below the mean high tide line falls within the Commission's original permit jurisdiction. The standard of review is the applicable policies of the California Coastal Act.

California Coastal Conservancy. The Coastal Conservancy is governed by a seven member Board appointed by the Governor and the California Legislature. The Coastal Conservancy has the authority to fund development and restoration projects within the Coastal Zone consistent with applicable Coastal Act policies. In addition to administering a grant program for local governments and non-profit groups, the Conservancy also engages in long range planning for the provision of coastal access, and the protection and restoration of unique coastal resources.

California Department of Parks and Recreation. The California Department of Parks and Recreation (CDPR) is governed by a 12 member Commission appointed by the Governor and the California Legislature. The CDPR is charged with the responsibility of developing and managing a system of state parks that include high intensity recreational facilities and ecological reserves containing representative examples of native California habitats. The CDPR develops General Development Plans for individual units of the State Park system and provides for the daily operation and maintenance of the facilities and grounds. Because it is a State agency, the Department of Parks and Recreation is normally exempt from local regulatory control. However, State Park units within the Coastal Zone are subject to the regulatory provisions of certified local Coastal Programs, or to the provisions of Public Works Plans adopted by the California

Coastal Commission. As noted above, the City of San Buenaventura has incorporated the Emma Wood State Beach General Development and Resource Management Plan into its Local Coastal Program (LCP); it has also provided for the updating of mapping of sensitive habitat areas through LCP Sensitive Habitat Policy No. 5.

Federal

U.S. Fish and Wildlife Service. The U.S. Fish and Wildlife Service (USFWS) is responsible for the management of fish and wildlife resources on federal lands, the regulation of migratory species, and for the management of Federally listed or candidate endangered and threatened species. The Fish and Wildlife Service is also engaged in the regulatory process through the U.S. Fish and Wildlife Coordination Act. This Act allows the USFWS to comment upon proposed projects under Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act. In addition to these regulatory activities, the U.S. Fish and Wildlife Service participates in the local regulatory process through comments on CEQA and NEPA documents, and provides technical services on a case by case basis. The USFWS also is responsible for administering the Endangered Species Act. This responsibility includes listing species (except anadromous species such as Salmon and Steelhead trout which are under the jurisdiction of the National Marine Fisheries Service) as rare and/or endangered, developing recovery plans, and prosecuting violations of the Endangered Species Act.

U.S. Army Corps of Engineers. The U.S. Army Corps of Engineers (USACE) is primarily concerned with the development of flood control facilities. However, the Corps is also the federal agency designated to implement Section 404 of the Clean Water Act and Section 10 of the River and Harbors Act that regulates the filling of wetlands and the dredging or discharge of materials into rivers, streams, and near shore coastal waters. The USACE offices are directed by a Regional Engineer, and its decisions are based upon the provisions of the Clean Water Act, the River and Harbors Act, and input from other federal agencies such as the U.S. Fish and Wildlife Service and the Environmental Protection Agency under the Coordination Act. The USACE oversees the maintenance of the Ventura River levee, and has established maintenance standards designed to ensure the facility functions at its design capacity.

<u>**Federal Emergency Management Agency**</u>. The Federal Emergency Management Agency (FEMA) is primarily responsible for responding to emergency situations such as flooding. FEMA provides money, expertise, and coordination in response to flooding, as well as planning assistance to local jurisdictions. In addition to its emergency response functions, FEMA also administers the Federal Flood Insurance Program and develops maps of flood-prone areas and standards for developing in such areas. FEMA standards are not specifically designed to protect environmental resources, but may encourage development away from flood prone lands and thus reduce impacts to riparian and other wetland habitat types.

<u>**Environmental Protection Agency**</u>. The Environmental Protection Agency (EPA) is the principal federal agency responsible for planning the overall quality of the Nation's environment, including air and water quality. The EPA engages in a wide variety of research and planning programs, and assists local, State, and regional jurisdictions through provisions of grants and technical expertise. The EPA is the agency chiefly responsible for the administration of the water quality provisions of the Clean Water Act, although its programs are often carried out directly through the State, where the State has been certified to act on behalf of the EPA as in the case of California through the State Water Resources Control Board and the Regional Water Quality Control Boards.

<u>**National Marine Fisheries Service**</u>. The National Marine Fisheries Service (NMFS) has responsibility for managing ocean fishes and migratory fishes such as Salmon and Steelhead trout. The NMFS provides basic data on fishery resources, and technical review of all federally sponsored projects affecting marine or migratory fishes. As noted above, the NMFS is responsible for administering the Endangered Species Act as it relates to anadromous fishes. It thus has regulatory authority over at least two species of fishes in the Ventura River, the Steelhead trout and the Pacific lamprey.

MANAGEMENT OPPORTUNITIES

Greater knowledge of the botanical resources of the Ventura River Group Camp and surrounding study sites enables us to identify and describe various opportunities for management of these resources. Because the habitats, vegetation, and wildlife in the study area form a natural reserve in an urbanized setting, an aggressive management plan for these biological resources will be necessary to ensure their preservation and co-existence with transportation corridors, urban encroachment, and recreational activities. Identification and mitigation of human impacts is an essential step in the management process.

Impacts on Botanical Resources

Adverse impacts on botanical resources result from human activities related to agricultural development, resource extraction (oil and alluvium), and urbanization of the region. We have identified four major categories of adverse impacts on botanical resources and the ecosystem of the study area.

Recreational Access. The State's designation of Emma Wood State Beach-Ventura River Group Camp as a State recreational unit (rather than a natural preserve), the neglect of the City's Seaside Wilderness Park, the historic unmanaged use of the Ventura River Delta area, and the recent development of car parking adjacent to the Ventura River Estuary, has led to generally uncontrolled pedestrian access to all environmentally sensitive habitats (Fig. 50). These habitats include coastal dunes, estuarine wetlands, marine wetlands, dune and beach swales, and riparian scrublands and woodlands. Such access has resulted in the formation of trails through habitats, the accumulation of refuse, the unauthorized development of camp sites, and the trampling of sensitive vegetation on dunes (Fig. 51) and in wetlands. Uncontrolled access by pets and feral predators also is widespread and impacts wildlife, including resident and migratory animal species.

Maintenance Programs. Maintenance programs associated with the State recreational unit (Ventura River Group Camp) and various transportation corridors (e.g., Southern Pacific Railroad) have resulted in serious impacts to botanical resources. Improved or new access roads for vehicular surveillance of

the Group Camp by State beach officials often extend through wetlands (Fig. 52), resulting in continual disturbance, loss of habitat, introduction of invasive exotic plants, increased access to other sensitive areas, and reduction of wildlife habitat values. Maintenance of the Southern Pacific Railroad line also affects the study area because embankments are sprayed with herbicides and trestle supports are maintained in seasonal wetlands. The latter activity has caused serious degradation of salt marsh habitat at the Second Mouth Estuary, particularly in association with a maintenance/surveillance road from the Group Camp that extends through the wetland, under the trestle, and to the dunes. Transportation corridors, including the Southern Pacific Railroad, U.S. Highway 101, Main Street, and access roads have produced significant fragmentation of habitat that contributes to the general degradation of the ecosystem. Periodic maintenance of the Ventura River levee and the Ventura River Channel by the Ventura County Flood Control District also involves removing natural vegetation, thus eliminating habitats and opening up disturbed area to colonization of invasive exotic plants. Despite this fragmentation and associated impacts of noise, increased access, and habitat loss, natural resource values remain high in the study area.

Invasive Exotic Weeds. Invasive exotic plants are often a problem in natural areas adjacent to urban centers. We have identified many species that are presently or that could be potentially threatening to native plants (See: Botanical Resources-Invasive Exotic Weeds). Giant Reed (*Arundo donax*) in riparian woodlands and Hottentot Fig (*Carpobrotus edulis*) on dunes (Fig. 51) are two examples of some of the more serious invaders. Impacts include loss of habitat for native plants, particularly sensitive species, and loss of native vegetation for wildlife habitat. Because of the area's proximity to urbanization and the altered nature of portions of the Ventura River Watershed, continual dispersal of existing and possibly new invasive exotic weeds is expected.

Reduced Water Quality. The generally acknowledged poor water quality in the lower Ventura River is the result of municipal, oil field, and commercial waste discharges in addition to non-point discharges from agricultural and urban runoff (See: Physical Environment). The increase in pollutants including nutrients and the increase in turbidity is accentuated by a reduced flow that is caused by diversion of water for direct use or storage in reservoirs by local water districts. The general absence of submerged aquatic species such as Pondweeds

FIG. 50. OBLIQUE AERIAL VIEW OF IMPACTS TO EMMA WOOD STATE BEACH–VENTURA RIVER GROUP CAMP, 1987. View southeastward from Group Camp (foreground) toward the Ventura County Fairgrounds (upper center). Visible impacts include disturbance and erosion of dunes, and maintenance and access roads in beach and dune swales and riparian woodland. Photograph precedes construction of Ventura Beach R.V. Resort (site at extreme lower left) and parking lot immediately east of the Ventura River Mouth. Both facilities have resulted in increased access to environmentally sensitive habitats.

FIG. 51. IMPACTS TO BOTANICAL RESOURCES AT VENTURA RIVER GROUP CAMP: EXCESSIVE ACCESS TO DUNES. Uncontrolled pedestrian access to dunes has eliminated much of the native dune vegetation and increased landward migration of dunes. The invasive exotic Hottentot Fig (right center) dominates some dune habitats, preventing colonization by native plants.

FIG. 52. IMPACTS TO BOTANICAL RESOURCES AT VENTURA RIVER GROUP CAMP: ACCESS ROAD IN WETLAND. View westward behind beach berm (upper left) along maintained access road in wetland dominated by Pickleweed (lower left) and Brewer's Saltbush. Route through wetland degrades wetland habitats, increases densities of exotic weeds, and encourages access into other sensitive areas.

(*Potamogeton* spp.) and Horned Pondweed (*Zannichellia palustris*) in riverine habitats of the study area probably reflects the loss of appropriate aquatic conditions that support these species. In contrast, the dense growth of exotic aquatic weeds such as Water Primrose (*Ludwigia uruguayensis*) is probably enhanced by the addition of nutrients from municipal wastes. Nutrients also increase the prevalence of freshwater algae that can often lead to depletion of dissolved oxygen as a result of its periodic die-off and subsequent decomposition. Furthermore, altered flows and reduced water quality have contributed to the decline of the Steelhead trout fishery in the Ventura River (Ventura County Fish and Game Commission 1973, Moore 1980). The overall ecosystem of the Ventura River and Estuary has been affected by impacts to water quality, reflecting the lack of an effective watershed management plan that is sensitive to the stewardship of natural resources.

Flood Control. Flood control actions have degraded various wetland habitats. The periodic removal of vegetation in the channel by mechanical means, in addition to eliminating habitats directly, disrupts the natural patterns of dispersal of plant propagules, breaks up the natural soil horizon that is conducive to native plant propagation, and creates opportunities for the spread and establishment of invasive exotic species. Additionally, the maintenance of flood control structures such as the Ventura River levee has resulted in the loss of native vegetation.

Other impacts. The reduction of sediment flows to the ocean, resulting from dammed rivers and sand and gravel excavations in riverbeds and flood plains, has contributed to the erosion of beaches and dunes throughout much of southern California (U.S. Army Corps of Engineers 1979, BEACON 1989). In the study area, about 200 feet (67 meters) of sand dune and beach habitats have been eroded during the last 30 years (BEACON 1989). This situation has seriously reduced the extent of Southern Coastal Dune vegetation, and coupled with excessive pedestrian access has resulted in landward migration of the remaining dunes and the loss of adjacent dune swale wetland.

Unique Management Areas

Recognition of human impacts and the identification of "unique" or

particularly sensitive habitats or plant and animal associations is an important step in developing a list of management opportunities for the study area. "Unique Management Areas" at the Ventura River Group Camp (Fig. 53) are those areas where a combination of habitat, biological resources, and sensitivity to impacts result in sites that need special and perhaps aggressive management techniques to preserve or restore their unique attributes. Although we have identified six such areas at the Ventura River Group Camp, others may exist not only here but also in adjacent sites at Seaside Wilderness Park and the Hubbard Property.

1. Second Mouth Estuary. The Second Mouth Estuary includes Estuarine Persistent Emergent Wetland and Subtidal Deepwater Habitats that have been degraded by the installation of utility lines and access roads, maintenance operations by the Southern Pacific Railroad, and deposition of alluvium during catastrophic flooding. The area includes a "northern marsh" of largely salt marsh vegetation north of the railroad, a "basin marsh" of largely brackish marsh and permanently flooded habitats, and a "southern marsh" of salt marsh vegetation south of the railroad, extending westward in a beach swale (Fig. 53). These wetlands are included in a proposed wetland restoration plan for the Second Mouth Estuary (See: Restoration Potentials - Fig. 54). The salt marsh vegetation is habitat for the endangered Belding's Savannah Sparrow. Management opportunities include removal of access roads and re-vegetation of disturbed soils, excavation of fill and restoration to a more flooded habitat, removal of invasive exotic plants such as Tamarisk, and controlled recreational access.

2. Southern Coastal Dunes. Remnant dunes at the Group Camp are highly disturbed and are colonized in part by an invasive exotic weed (Hottentot Fig). This habitat is very vulnerable to disturbance from trampling and is currently migrating landward, which is due in part to loss of vegetation that stabilizes sand blown by landward breezes. Wave erosion of sand beach and dune deposits also have contributed to the decline of this habitat. Management opportunities include elimination or reduction of access, removal of Hottentot Fig, and revegetation of disturbed areas with native species. Such efforts should be coordinated with the dune revegetation plan for Ventury County Fairgrounds property east of the Ventura River Estuary (See Philbrick 1988).

3. Dune Swale Wetland. This habitat extends from near the Second Mouth Estuary eastward into Seaside Wilderness Park. Several plants such as Yerba Mansa and Basket Rush are restricted to this wetland within the study area. Access trails, fire, landward migration of dunes, and drought conditions have reduced the viability of this site for some herbaceous species, but have enhanced the site for many coastal shrub species. Management opportunities include stabilization of dunes, limited access, and potential restoration to improve the site's wetland values.

4. Upper Ventura River Estuary. This area supports Estuarine Nonpersistent and Persistent Emergent Wetland (brackish marsh) and is habitat for Tidewater goby and Steelhead trout. Quality of the habitats would be improved with improvements in water quality, and thus policies regarding watershed management significantly affect the site. The habitats are contiguous downstream to the Lower Ventura River Estuary and Marine Wetlands at Seaside Wilderness Park and upstream to Riverine Wetlands on the Hubbard Property. Management opportunities include the development and implementation of a management plan for the entire study area that integrates the special habitat requirements for wetlands at the Ventura River Group Camp, Seaside Wilderness Park, and the Hubbard Property.

5. Flood Plain Mixed and Willow Forests. Although most of the western flood plain is dominated by a mosaic of riparian scrubland and woodland, the Mixed Forest type of Palustrine Forested Wetland is rich in native riparian tree, shrub, and liana species (See: Botanical Resources - Palustrine Forested Wetland). It is potential habitat for Least Bell's Vireo and other rare or declining bird species such as Yellow-breasted Chat and Swanson's Thrush, each of which has been recorded for the study area (P. Lehman, UCSB, pers. comm., Sep 1989). The vegetation also supports California Walnut (*Juglans californica*), the characteristic element of a State listed threatened habitat (California Walnut Woodland). Impacts to the area have included unauthorized encampments, fragmentation by maintained access roads, expansion of invasive exotic weedy plants, and uncontrolled recreational access. Management opportunities include reduction in access and removal of invasive exotics.

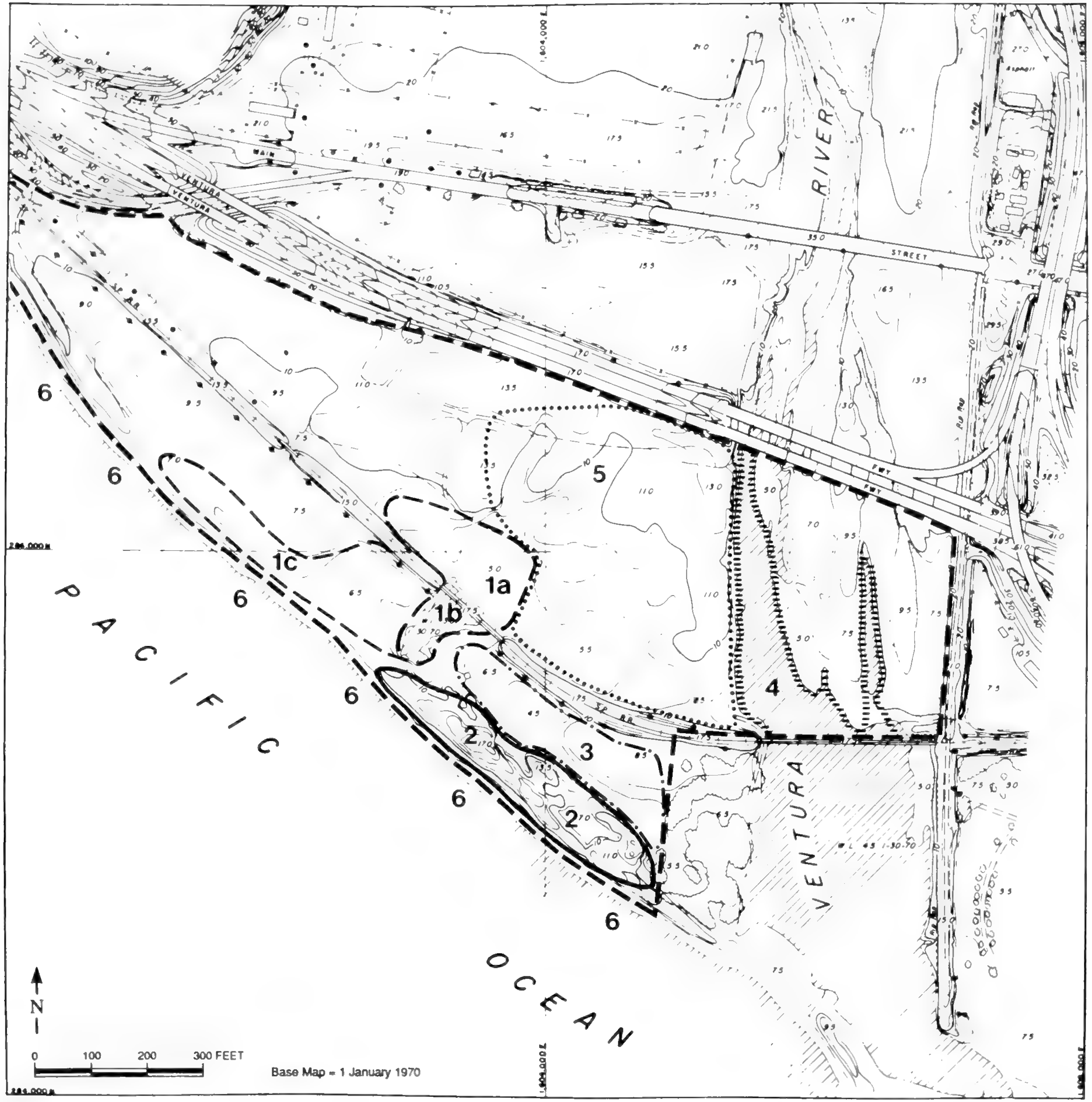

Fig. 53. Management Opportunities: Unique Management Areas at the Ventura River Group Camp

1. Second Mouth Estuary (— — —)
   a. northern marsh (Estuarine Emergent Wetlands)
   b. basin marsh (Estuarine Subtidal Habitats and Emergent Wetlands)
   c. southern marsh (Estuarine Emergent Wetlands and Palustine Scrub/Shrub Wetlands)
2. Southern Coastal Dunes (———)
3. Dune Swale Wetland (—·—·) (Palustrine Emergent and Scrub/Shrub Wetlands and Transitional Habitats)
4. Upper Ventura River Estuary (ııııııııııı) (Estuarine Subtidal Habitats and Intertidal Wetlands)
5. Floodplain Mixed and Willow Forests (••••••) (Palustrine Forested Wetland)
6. Marine Cobble Fields (Marine Tide Pool Wetlands and Deepwater Habitats)

— — — — Boundary of Ventura River Group Camp

Botanical Resources at Emma Wood State Beach and the Ventura River Estuary: Inventory and Management.
Herbarium of the University of California, Santa Barbara 1989.

6. Marine Cobble Fields. The marine cobble fields in the study area represent a significant percentage (37%) of the total hard substrate along the Ventura County coast. The intertidal cobble fields support over a hundred species of native marine algae, as well as many species of marine invertebrates and fishes. These habitats are the least disturbed habitats in the study area. However, the recent development of a 328 car parking lot adjacent to the east side of the Ventura River Estuary has resulted in the introduction of large numbers of individuals into the intertidal area. Management opportunities include the establishment of a Marine Ecological Reserve over the intertidal area, and the development of a vigorous public education and interpretive program designed to control access and prevent the excessive harvesting of resources, particularly invertebrates such as cockles and other clams.

Alternatives for Removal of Invasive Exotic Weeds

We have identified impacts from invasive exotic weeds as one of the significant problems in the general study area. We also mapped (Appendix IV) and detailed aspects of nine invasive species and listed eight others that are potentially invasive (See: Botanical Resources - Invasive Exotic Weeds). Because germination of existing seed bank material or the reintroduction of these weeds is expected, control of them is more practical than complete eradication. Five alternatives for control of exotics have been identified: manual, mechanical, biological, chemical, and fire. Although each of these alternatives might be appropriate or preferred under particular conditions, one or a combination of them may be more appropriate in other situations.

Manual Control. Manual control (hand removal) is the preferred alternative for many species of invasive exotics because chemical or biological agents do not have to be added to the environment and the disturbance caused by fire and mechanical control can be avoided. It is not practical for some species, however, because of the size of the plants and the potential for disturbance of habitats. Thus, manual control is suggested for removal of Hottentot Fig, Sea Fig, and Ice Plant from dunes, and the isolated or scattered individuals of Tamarisk, Spanish Broom, Pampas Grass, Hoary Cress, New Zealand Spinach, Kikuyu Grass, and Sweet Fennel that occur in dune swales, estuarine wetlands, flood plain and riverbed habitats, and ruderal areas. We also suggest hand removal of German Ivy

from riparian woodland sites. Thoroughly tangled areas or recurring populations should also be treated chemically (see below).

<u>Mechanical Control</u>. As advocated here, we suggest mechanical control to include only the use of hand-held equipment rather than vehicles such as bulldozers and loaders. Thus, this alternative is actually an extension of manual control. Larger individuals of many species that cannot be removed by hand or with a shovel may require a saw or other powered equipment. Trees and shrubs of Castor Bean, Salt Cedar, Myoporum, and Tree Tobacco may have to be cut down and then removed. Disturbance of the substrate during this process and the increase of light resulting from the removal of individuals may improve conditions for the germination of other weeds that would require treatment.

<u>Biological Control</u>. Control of invasive plants by insects and pathogens can be effective, but is not proposed here largely because the species most problematic in the study area are not controlled biologically at other sites. Hottentot Fig is attacked by two scale insects from South Africa that is wind dispersed (Schmalzer and Hinkle 1987). Because the colonies of Hottentot Fig at the Ventura River Group Camp could be controlled by other means, we do not recommend the use of scale insects at this time.

<u>Chemical Control</u>. Some invasive species are most effectively eliminated by herbicides. This is particularly true for Giant Reed. Demery (1987) describes the methods for chemically eliminating weeds from wetlands in Santa Barbara County. He indicates that systemic contact herbicides such as "Rodeo" and "Roundup" are diluted with water and sprayed onto the target plants by handgun with hose extension. The herbicides enter the plants through leaves and interfere with metabolic processes. Both of these herbicides are reported to be non-volatile, contain the active ingredient "glyphosate" that binds to soil particles and does not leach from the soil, and biodegrade quickly. "Rodeo" is preferrable to "Roundup" because it is labeled for use in all types of aquatic sites and has been assigned by the Environmental Protection Agency to the lowest toxicity category established for herbicides (Demery 1987). At Ventura River Group Camp, "Rodeo" could be used to kill Hottentot Fig, Pampas Grass, and dense patches of several species (e.g., New Zealand Spinach, Sweet Fennel, Kikuyu Grass, Water Primrose, Hoary Cress, and German Ivy) before they are removed manually or permitted to

decompose in place. In the case of Giant Reed, large colonies should be cut down to smaller heights before the plants are treated. Cut culms should be resprayed until growth discontinues and the colony dies. Because flood waters disperse roots of Giant Reed that produce new colonies downstream from parent colonies, the study area will probably receive new introductions periodically, and thus removal of the species will have to be conducted periodically. Spot spray of ruderal areas to eliminate various noxious weeds (e.g., Juvenile Castor Bean, Italian Thistle) is recommended where infestations are particularly large.

Fire Control. Although control of exotic species by fire has been considered for the study area (California Department of Parks and Recreation, 1987), there are many disadvantages to this approach. Fire generally does not kill Giant Reed and Pampas Grass, two species targeted for elimination by it. Fire opens substrates for colonization by other invasive weeds such as Hottentot Fig, the seeds of which are known to respond to burning of sandy soil habitats in Santa Barbara County (Schmalzer and Hinkle 1987). Fire would eliminate, perhaps temporarily, native vegetation and wildlife habitats, and destroy aesthetic and recreational aspects of riparian scrublands and woodlands. There are no identifiable reasons for the use of fire at the Ventura River Group Camp for the sole purpose of controlling invasive exotic weeds. We therefore do not recommend fire as a method of controlling invasive exotics in the study area.

Finally, we would recommend that the California Department of Parks and Recreation work with the County of Ventura and the Cities of Ojai and San Buenaventura to develop a comprehensive plan to control the spread of invasive exotic species in the Ventura River Watershed. Such a plan could include the adoption of policies requiring (1) the use of native species in landscaping of projects adjacent to the river channel or its tributaries, and (2) the removal of invasive exotic species as part of flood control maintenance activities, new development adjoining water courses of the Ventura River system, and/or a general weed nuisance abatement program.

Alternative Responses to Potential Sea Level Rise

Natural resources of the Ventura River Delta area may also be at risk from the effects of global change. One example of a predicted effect on coastal habitats

is a rise in sea level as a result of an increase in global warming. A summary of climate change and its potential effects on wetlands in California has been compiled by Ferren (1989b), and is summarized herein.

Global warming is a product of the Greenhouse Effect, a natural physical process whereby atmospheric gases absorb some of the infrared (heat) energy radiated from the earth (California Energy Commission 1989). This process is largely responsible for producing the warmer atmospheric temperatures under which life has evolved. Industrialization and exploitation of the earth's natural resources, however, have caused a substantial increase in the concentration of carbon dioxide and other "greenhouse gases" (Hengeveld 1987). This increase can have a profound effect on the temperature of the atmosphere. A global average annual increase of 4°C is predicted (Rind 1989) to occur with the doubling of the carbon dioxide content above pre-industrial levels. These estimated changes in global climate are expected during the next century (California Energy Commission 1989; Titus 1989), although atmospheric recordings also reveal current increases (Hengeveld 1987).

Impacts from global warming have been estimated with great uncertainty and much variability. Recent treatments of the subject (e.g., Smith and Tirpak 1988; Titus 1988; California Energy Commission 1989; EPA 1989), however, concur on major categories of environmental change that will occur. In addition to increased concentrations of greenhouse gases and coincident higher temperatures, predictions for the next century include a corresponding increase in acid rain and ozone (Durman 1989), a potential change in patterns, amounts, and type of precipitation (J. E. Smith 1989), and a rise in sea level (Titus 1988a, 1989).

One plausible scenario (Knox 1989) resulting from the Greenhouse Effect could be the doubling of carbon dioxide by the year 2030, a corresponding 3°C rise in temperature, and a one meter rise in sea level. Such a scenario is likely to have catastrophic effects on some coastal wetlands and variable effects on other wetlands, which may be more difficult to predict. For example, a significant and relatively quick rise in sea level would inundate and destroy many coastal wetlands, change the species composition of others due to the increase in salinity, and further exacerbate the status of many endangered species. Changes in temperature, precipitation, and air quality could provide environmental stress from

increases in acidity of some aquatic systems, increases in evapotranspiration, and increases in amounts and timing of runoff (EPA 1989).

Marine System. Impacts to marine wetlands as a result of global warming will come largely from an anticipated rise in sea level. There has been approximately a 30 cm rise in sea level along much of the coast of the United States during the past century (Titus and Barth 1984). Global warming could rise sea level as much as one meter in the next century, because of thermal expansion of oceans and the melting of ice sheets (Titus and Barth 1984). A 5-7 meter rise could occur over the next few centuries if temperatures are sufficiently high to produce the melting of the West Antarctic ice sheet (Titus and Barth 1984). Accentuating the effect of sea level rise is the simultaneous subsidence of some areas such as Ocean Beach, California, which currently subsides about one inch per century (Wilcoxen 1986).

Potential impacts from sea level rise will include the conversion of intertidal wetlands to deepwater habitats and the disruption of marine life. If sea level rise exceeds the rate of rocky shoreline retreat, intertidal marine habitats in some areas may be lost. In other areas, artificial barriers may exist or may be built to protect coastal real estate and could further limit the landward migration of marine wetlands. A rise in sea level of one-third meter could erode beaches 67-133 meters in California (Titus 1989), but because many are not this wide, substantial loss of marine intertidal zones, wetland habitat, and recreational sites could be expected in urban areas with seawalls. Nearly 10% of California's coastline currently requires protective structures to prevent the destruction of real estate, topography, and wetlands (California Coastal Commission 1989). Should the rise in sea level be only one-half meter, Titus (1989) estimates one-third of coastal wetlands (marine and estuarine?) in the United States would be inundated. Other impacts will occur from the altered effects of wave action and storm surges, an increase in ocean temperature, and potential changes in ocean currents and atmospheric patterns. A disassociation or poleward displacement of entire marine wetland biotas is a possible result of the combined effect of these changes.

At the Ventura River Delta, a meter rise in sea level could cause (1), the landward migration of intertidal marine wetlands and dunes, which would result in the loss of dune and beach swale wetlands; (2), the upriver migration of the cobble

bar at the mouth of the estuary or the complete elimination of the bar. The railroad berm could be jeopardized by encroaching dunes and waves, particularly at the western portion of the Group Camp.

Estuarine System. Because of the biological and socio-economic values associated with estuarine wetlands and the sensitivity of these habitats to many impacts, much has been written recently on the potential effects of sea level rise as related to these resources. Modeling conducted for the EPA revealed that 40-73% of the study wetlands in the United States could be lost by the year 2100, but that the potential formation of new wetlands might reduce this loss to 22-56% (Armetano et al. 1988). Other estimates include a 30-70% loss with one meter rise and 33-80% loss with a two meter rise, 90% of which would be in the southeastern United States (Titus 1988b). In California, 35-100% of the EPA study wetlands were projected to be lost during the same period. This loss could be reduced to 1-18% if developed or protected areas were abandoned to allow landward migration of wetlands (Armentano et al. 1988; Titus 1988b). For all of the United States, Titus and Barth (1984) have stated that, "Perhaps the most serious environmental consequence [of sea level rise] would be the inundation of thousands of square miles of marshes and other wetlands."

Estuarine wetlands as a whole are limited in California and are estimated to be only 10-20% of the coastal area, whereas 71% of the Atlantic Gulf coasts of the United States support estuarine wetlands (Armentano et al. 1988). This limited occurrence is largely the result of an emergent coastline and loss due to agricultural development and urbanization. At least 75% of the estuarine wetlands of southern California are estimated to have been destroyed in the last century (Zedler 1982), and most of the remaining ones are either degraded, fragmented, or isolated remnants of historically larger wetland systems. The California Coastal Commission (1989) estimates that about 90% of the coastal wetlands of southern California have been filled or dredged. Landward migration of wetlands as a result of sea level rise will be constrained by abrupt topography of the coastline and artificial barriers constructed to protect agricultural lands and urban areas.

The most important information on the effects of global warming on California's wetlands has been compiled for the San Francisco Bay region, where the majority of coastal wetlands occur. It is also the only region in California

where agency policy related to sea level rise has been established (SFBCDC 1987). San Francisco Bay was formed 6-10 thousand years ago when a "rapid" rise in sea level occurred from global warming after the last ice age (Williams 1985). For the last 5-6 thousand years the rate of sea level rise dropped to about one-half foot per century, allowing sediment to accumulate and marshes to form (Williams 1985; Josselyn and Callaway 1988). A rise in sea level by one meter by the year 2030 would exceed sedimentation rates, cause the expansion of the Bay, and inundate many marshes, cause the landward migration of wetlands where feasible, and increase salinities in the rivers of the Sacramento/San Joaquin Delta (Williams 1985; Gleick 1988; California Energy Commission 1989; Josselyn and Callway 1988).

Modeling of impacts for climate change scenarios and estimation of impacts from sea level rise also have been conducted for other estuaries. For example, Armentano et al. (1988) found that, with a one meter rise in sea level by 2100, several estuaries in southern and central California would receive major impacts; however, many estuaries in these regions cover less than one square kilometer and were not included in their study. At Oxnard (Mugu Lagoon region), they project that marsh vegetation will become intertidal mud flats and subtidal habitats. At Del Mar, salt marsh vegetation would survive in several small estuaries provided it could migrate onto adjacent freshwater marshes and lowland sites such as deltas. At Imperial Beach San Diego Bay and Tijuana Estuary, freshwater marsh would persist in "sheltered" or protected locations. Management efforts at Tijuana Estuary, however, have provided for important transition habitats and broad buffers that could accommodate a landward migration of wetlands with sea level rise (J. Zedler, pers. comm., Pacific Estuarine Research Laboratory, 1989). At Santa Ynez River, the model by Armentano et al. predicted no estuarine wetlands would survive the rise in sea level because abrupt topography of adjacent uplands would prevent the landward migration of wetlands. Such is the case for many estuaries in central and southern California, especially those that occur at the mouths of incised canyons and rivers adjacent to emergent marine terraces.

The Ventura River Delta area is an example of a site where a rise in sea level could be accommodated by existing land use practices and where landward migration of estuarine wetlands could occur, causing the expansion of the estuarine habitat of the Ventura River Estuary through the flooding of the "Hobo Jungle"

area. Such an event, however, would cause the displacement of riverine and palustrine wetlands. Other expected phenomena include a rise in and increased salinity of the water table, which could produce an expansion of permanent flooding in the wetlands of the Second Mouth Estuary.

Riverine System. A rise in sea level also could have profound effects on the riverine wetlands of California (See: Estuarine Wetlands), especially in the vicinity of the Sacramento/San Joaquin Delta (Gleick 1988; Titus 1989; California Energy Commission 1989). A rise in sea level by one meter will cause significant movement of salt water up rivers and change tidal riverine wetlands and deepwater habitats into estuarine wetlands and deepwater habitats. This process would be harmful to organisms restricted to freshwater habitats and could seriously threaten human uses of fresh water derived from these sources (Titus 1989). Stress in wetlands as a result of increased salinity may alter species distributions and successional patterns of plant communities (Pezeshki et al. 1987). Reduced spring and summer flows and a potential decrease in precipitation would increase the potential for movement of salt water into riverine wetlands.

Competition between human uses of water resources and requirements to maintain natural ecosystems could result in serious conflicts. To preserve the freshwater nature of riverine and adjacent palustrine wetlands, water may have to be released from reservoirs to augment reduced spring and summer flows of rivers that empty into estuaries, thereby forcing salt and brackish water back to bays (Titus 1989). However, potentially increased human demands on water resources, partly from the anticipated higher temperatures, may make this alternative impossible. Construction of new reservoirs to provide additional holding capacity to capture potential increased winter runoff would cause the destruction of other riverine habitats where the reservoirs would be built, and could further reduce sediment input to areas such as the Sacramento/San Joaquin Delta, limiting the potential for estuarine wetlands to keep pace with a rise in sea level.

At the Ventura River Delta, the transition of the riverine and estuarine systems would move upriver and beyond the area of this study. The upper limit of the estuary would move northward of Main Street Bridge. Although this may not have a profound effect on rare or sensitive biological resources, ownership and management responsibilities for the transition could be shifted to other parties.

Palustrine System. Various types of palustrine wetlands adjacent to or landward of estuaries and/or impounded by levees would be threatened throughout California by a rise in sea level because of increases in inundation and salinity (See: Estuarine System). Particularly vulnerable are those marshes in the Delta and South Bay regions of San Francisco Bay (Armentano et al. 1988; California Energy Commission 1989; Josselyn and Callaway 1988). Emergent wetlands dominated by tules and cattails, seasonal alkali wetlands on deltaic deposits, salt ponds, and nontidal brackish marshes in historic estuarine areas could be permanently inundated with a one meter rise in sea level during the next century, especially if the levee system in the Delta region was not maintained. Palustrine wetlands would be displaced by estuarine wetlands with important but different habitat, endangered species, and food chain support values. If levees are maintained and palustrine marshes preserved, or if spring and summer river flows are augmented with reservoir water to keep salt water out of the delta region, then freshwater and other palustrine marshes could persist in the San Francisco Bay region (Gleick 1988; Armentano et al. 1988).

At the Ventura River Delta, dune and beach swale wetlands and various Palustrine scrub/shrub and Forested Wetlands would be threatened by a meter rise in sea level because the landward migration of marine and estuarine wetlands would cause a replacement of palustrine wetlands. The extent of the change would be constrained by topography and artificial structures, and thus many areas could be protected from inundation. Other changes in the palustrine wetlands, however, could result from a raised water table that might cause some upland habitats to be converted to palustrine wetlands or might cause freshwater wetlands to be converted to brackish water wetlands should there be an increase in the salinity of shallow ground water associated with a rise in sea level.

Alternatives. Various actions can be taken at Emma Wood State Beach and Seaside Wilderness Park to prepare for a potential rise in sea level. These include:

- Record baseline information on hydrology, tidal inundation, salinity, sedimentation, and aquatic resources.
- Implement a long-term monitoring program to record potential changes and link with other monitoring programs for comparison of effects along the coast of California.

* Identify sites where landward migration of marine and estuarine wetlands are most likely to have the greatest effect and plan for these sites to accommodate the change.
* Incorporate potential for change into all plans for habitat restoration and public access.
* Locate and acquire areas where landward migration of wetlands is expected to occur so that the expansion of the estuary can be accommodated.

Restoration Potentials

Restoration of wetlands (1) at the Second Mouth Estuary and (2) in dune and beach swales, and restoration (3) of natural vegetation on dunes, and (4) of riparian woodlands are the four priorities emphasized for the Ventura River Group Camp in this report. Impacts to botanical resources and wildlife values in these habitats are serious (See: Management Opportunities-Impacts, Botanical Resources-Invasive Exotic Weeds). Natural resource and interpretive values of Ventura River Group Camp will be substantially improved if the wetland and dune habitats are restored and protected.

Second Mouth Estuary. A marsh restoration map was prepared previously in 1978 for wetlands at the Second Mouth Estuary (Fig. 54). This earlier proposal included the excavation of existing filled areas to remove alluvium that was deposited in the basin as the result of (1) the removal of one of the railroad truss bridges, (2) catastrophic flooding, and (3) the installation of utility lines. Wells were dug to locate the water table to determine the depth to which excavation should be conducted to re-establish permanent open water. Well logs indicate the depth to ground water between 1.5 and 3.5 feet (0.46-1.07 meters) (Meisenbach 1975).

Current impacts to the area include access roads through wetlands, fill from the Southern Pacific Railroad, invasive exotic plants, desiccation, and flood-deposited alluvium. One proposal for access and interpretation (See: Potential Interpretive Themes) includes abandonment of the road through the Second Mouth Estuary. We suggest that any additional construction or repair of the railroad trestle include full mitigation of impacts and exclude any additional

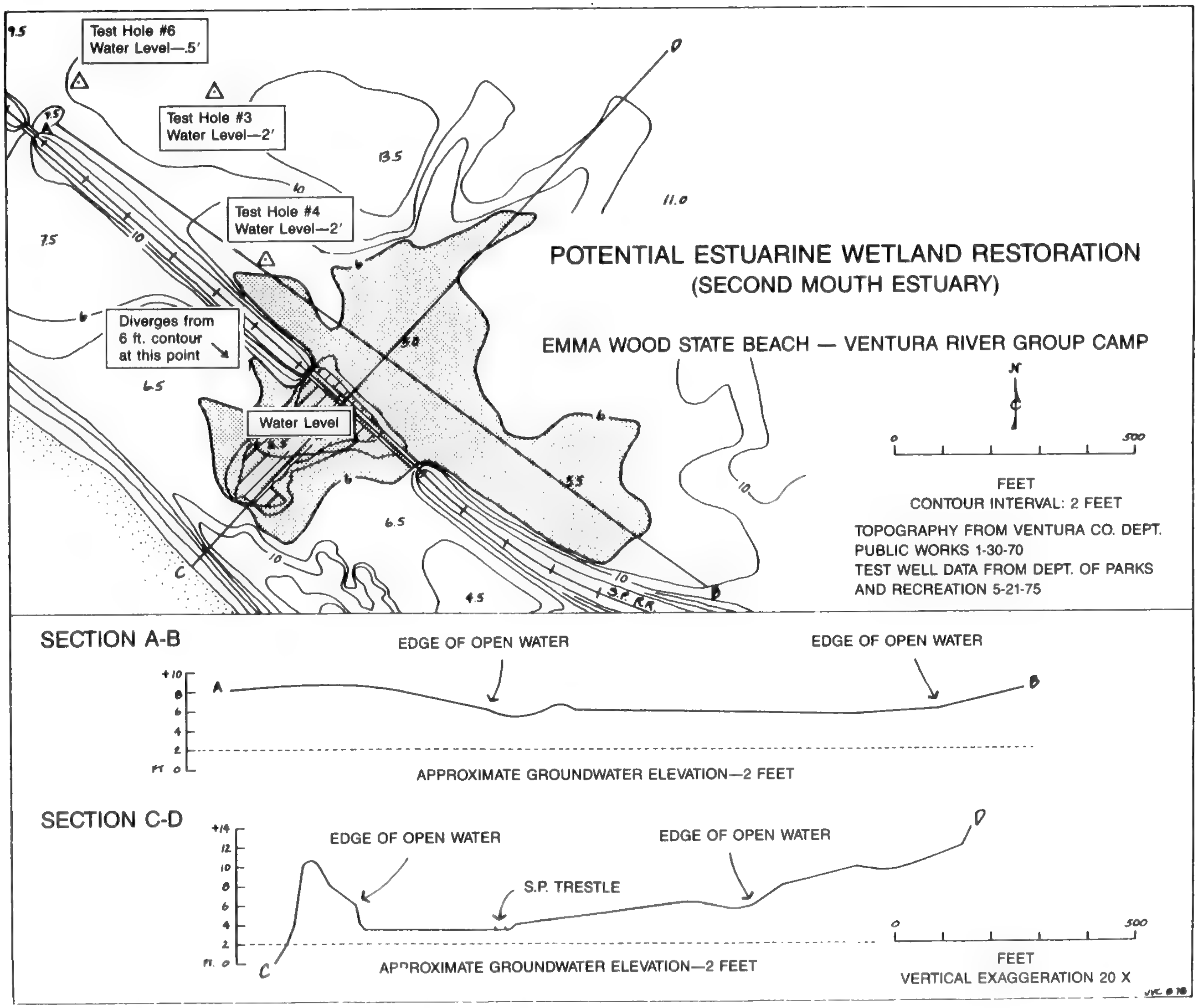

FIG. 54. PROPOSED MARSH RESTORATION AREA: EMMA WOOD STATE BEACH, 1978. This map illustrates a potential wetland restoration plan for estuarine wetlands at the Second Mouth Estuary of the Ventura River.

filling of wetlands. We also recommend eradication of weeds such as Tamarix. We support in concept the plan illustrated in Figure 54, but suggest that a detailed restoration plan for the habitats be developed. In this plan, all existing biological values of the site should be identified and evaluated for potential preservation so that present desirable values are not exchanged for created ones that may be unsuccessful alternatives.

Beach and Dune Swales. Identified impacts include maintained access roads (Fig. 52), access trails, refuse piles, and landward migration of dunes and beach cobble. Restoration potentials include removal of refuse, abandonment of access roads and restoration of vegetation, stabilization of dunes, and excavation of sediments to approximate depth of water table, at least in the Dune Swale Wetland.

Southern Coastal Dunes. Identified impacts include excessive pedestrian access, erosion, and invasive exotic weeds (Figs. 44, 45, 51). Restoration potentials include the elimination or reduction of pedestrian access, the eradication of invasive exotics such as Hottentot Fig, and the revegetation of habitats now disturbed. Stabilization of dunes with native vegetation will reduce the likelihood or decrease the pace at which they will migrate landward and fill in the Dune Swale Wetland. Access should be confined to that conforming with the proposed interpretive plan (See: Potential Interpretive Themes). Any dune restoration plan should be coordinated with the restoration plan proposed by Philbrick (1988) for degraded dunes east of and adjacent to Seaside Wilderness Park and the Ventura River Estuary in the City of San Buenaventura.

Riparian Woodlands. Impacts to these Palustrine Forested Wetlands and the adjacent riparian scrublands include fragmentation by access corridors, disturbance from road maintenance, unauthorized camps, and invasive exotic weeds. Restoration potentials include abandonment of unnecessary vehicular maintenance/surveillance routes, cleanup and revegetation of disturbed margins of access routes, eradication of invasive exotics such as Giant Reed, Castor Bean, and German Ivy, and regular cleanup of refuse. A program for the control of feral predators might enhance the community for native animals. All restoration efforts should be coordinated with the implementation of an "Access and Interpretive

Plan" that should include educational themes on the value of these natural areas and the need for resource management (See: Potential Interpretive Themes).

Group Camp. The Ventura River Group Camp is situated at the upper margins of the Ventura River flood plain and was originally vegetated by an extensive wetland and transitional upland forest characterized by a number of tree species such as California Sycamore, Black Cottonwood, and Coast Live Oak. These species are entirely absent from the study area, or are now highly restricted. This area has been heavily disturbed by previous human uses (e.g., agriculture, pipe storage). Current vegetation is largely introduced ornamentals and some invasive exotics with limited habitat value. Partial restoration of this area could be achieved through the use of native shrubs and trees in place of introduced species. Landscaping with selected riparian tree species would restore an important missing component of the riparian plant community, and would provide opportunities for wildlife observation (particularly birds and small mammals) within the Group Camp area. (For an example of a riparian restoration plan for San Simeon State Park, See Capelli 1985). We would recommend a landscape plan that would be compatible with the existing recreational facilities and activities, but that would also enhance natural wildlife values.

Research Opportunities

The biological richness of the study area is directly related to the interfacing of four wetland systems (Marine, Estuarine, Riverine, Palustrine) and adjacent uplands. In spite of urbanization and transportation corridors that have fragmented and diminished various habitats, the region of the Ventura River Delta provides many opportunities for research. These opportunities can be focused to assist directly with the inventory of the resources, with the monitoring of environmental conditions, the identification of managerial problems and solutions, and the development of interpretive programs for park visitors. Examples include:

Inventory

Continuation of the terrestrial botanical inventory to include additional field surveys and herbarium searches for historical occurrences of native plants, particularly sensitive species.

Continuation of the inventory of marine algae to enhance the preliminary study conducted as part of this project, and expansion of the study to include estuarine and riverine species of algae.

Initiation of a thorough inventory of vertebrate zoological resources (avifauna, fish, mammals and herpetofauna), including information from field surveys, museum records, and observations of regional experts.

Initiation of a thorough inventory of terrestrial and aquatic invertebrates emphasizing, for example, marine and estuarine species, freshwater species, and species of narrowly restricted terrestrial habitats such as dunes.

Initiation of comparative studies to determine the relationship (richness, quality, uniqueness) of the natural resources with those of other southern California river mouths and estuarine systems.

Monitoring

Initiation of a periodic monitoring program of vegetation and vascular plant species on the nine transects established during this study.

Establishment of permanent transects in the intertidal wetlands to monitor potential changes in the spatial and temporal relationships and population levels among marine organisms.

Establishment of transects to monitor the expected rise in sea level predicted for the next century.

Establishment of trapping or sampling program of animals to develop a data base that could suggest habitat values of the study area for any species of special concern and for native fauna as a whole.

Establishment of a trapping program to determine the extent of feral predators use of the habitats and their possible impacts to native fauna and habitats.

Establishment of an independent water quality monitoring program to compare data with those compiled by the Casitas Water District, the City of San Buenaventura, and others, to identify links between water quality and instream biotic values.

Establishment of an estuarine monitoring program to identify the filling and breaching pattern of the estuary, and the corresponding changes in physical and chemical characteristics of the estuary such as salinity and temperature stratification.

Experimentation

Implementation of habitat restoration and resource management programs that include revegetation plans, recovery performance criteria, faunal use, and monitoring of the habitat values of restored or created communities.

POTENTIAL INTERPRETIVE THEMES

We propose the use of selected existing trails and roads, the placement of interpretive panels or signs, the publication of brochures, and the use of docents as an integrated plan to inform users of the Ventura River Group Camp that there are many important and interesting natural resources in the vicinity of the Ventura River Delta and that effective stewardship of the resources is the responsibility of everyone. A preferred route for the interpretive trail and potential interpretive themes are presented in Figure 55. Although we propose that a looped trail be maintained for limited but meaningful access, we also propose the elimination of some trails/roads and the restoration of these disturbed areas (See: Management Opportunities-Restoration Potentials). At least nine potential themes could be emphasized at different sites along the interpretive trail (Fig. 55). These themes include:

1. **Ventura River Delta and Marine Wetlands**. Interpretive site would include information on the Ventura River Watershed, formation of the delta, and marine resources along the intertidal zone of the delta.

2. **Geological Processes**. Interpretive site would include information on the geological processes that have shaped the landscape and resulted in the formation of the habitats at the Group Camp (See: Physical Environment - Geological History).

3. **Second River Mouth Estuary**. Interpretive site would include information on the formation of the Second Mouth Estuary and its role during periods of catastrophic flooding.

4. **Coastal Dunes**. Interpretive site would include information on the formation of dunes, the plants and animals that colonize them, and their sensitivity to impacts from recreational access.

5. **Dune Swale Wetland**. Interpretive site would include information on the hydrology and biology of the dune swale, including the locally uncommon species that colonize it such as Basket Rush and Yerba Mansa and the use of these plants by Native Americans.

6. **Ventura River Estuary**. Interpretive site would include information on the nature of estuaries, their biological resources and wildlife values, and the particular importance of this estuary to species of special interest, to anadromous fish such as Steelhead trout and Pacific lamprey, and to the interesting interface of four wetland systems in the vicinity of the Ventura River Mouth (See: Physical Environment and Botanical Resources).

7. **Palustrine Forested Wetlands**. Interpretive site would include information on the riparian woodlands that dominate flood plain and

riverbed habitats, including the characteristic plants and the wildlife habitat values of the community.

8. **Transitional Riparian Scrublands and Forests.** Interpretive site would include information on the development of flood plain habitats, the vegetation characteristic of sites transitional between upland and wetland habitats, and the wildlife values of the mosaic of plant associations.

9. **Estuarine and Palustrine Wetlands at the Second Mouth Estuary.** This final interpretive site on the loop trail would include information on the transition between estuarine and palustrine wetlands of the Second Mouth Estuary and a general summary of the functional relationships among the physical environmental processes of the study area and the biological resources associated with them.

We have excluded the City's Seaside Wilderness Park and the Hubbard Property from explicit consideration in the potential access and interpretive plan because of the focus of this study. Although the Hubbard Property is isolated from the Group Camp (as is the eastern flood plain portion of the State Beach), Seaside Wilderness Park is contiguous to habitats at the Group Camp and contains trails that are linked to the Group Camp. Coordination of plans with the City of San Buenaventura could result in a more meaningful stewardship of the resources and a more meaningful use of the interpretive values of the Ventura River Delta area.

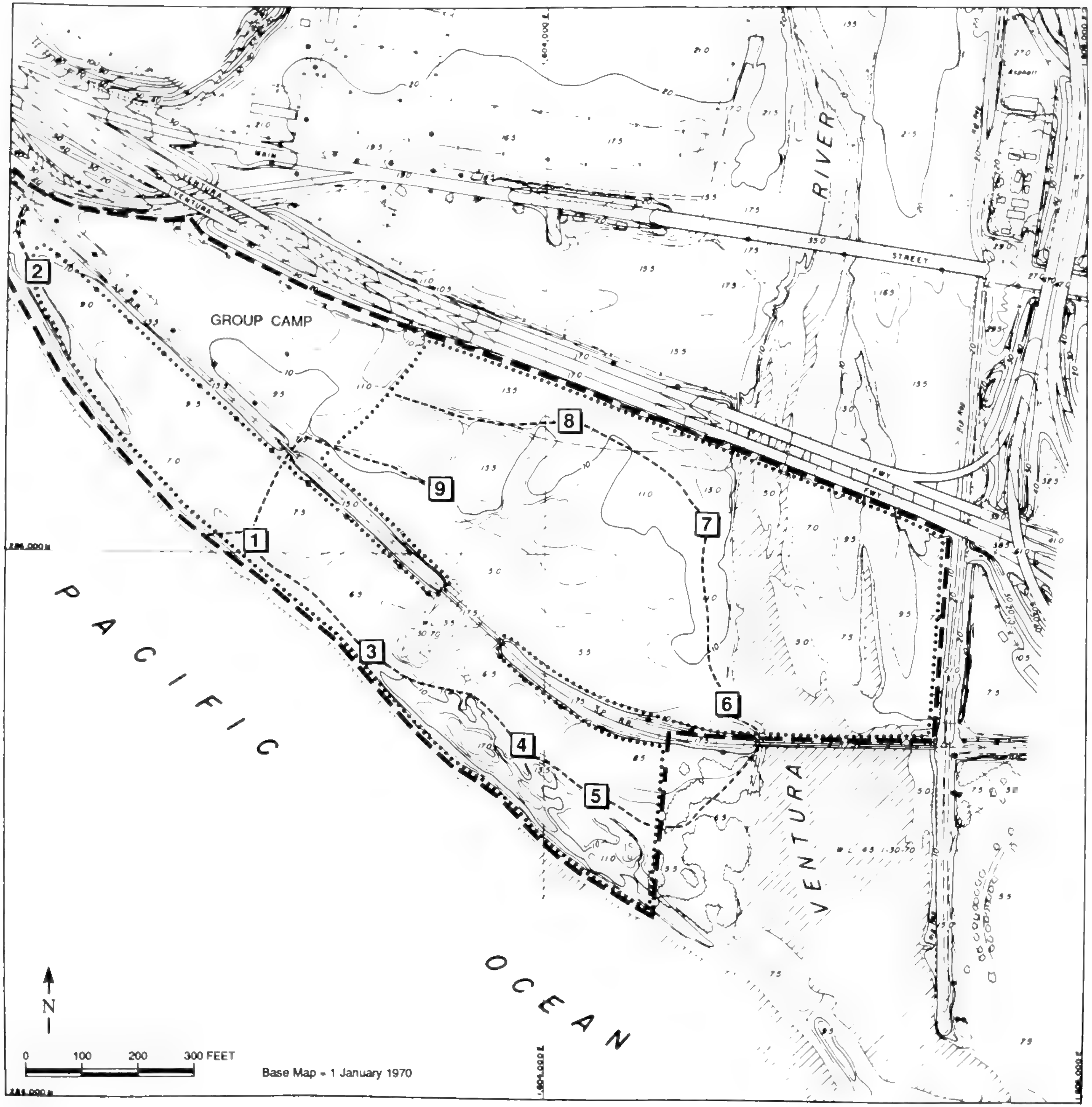

Fig. 55. Potential Interpretive Trails and Sites at Emma Wood State Beach-Ventura River Group Camp

Boundary of State Beach

Existing Trails/Roads

Proposed Informative Kiosks/Signs

Proposed Natural Preserve Boundary

Interpretive Themes

1. Ventura River Delta and Marine Wetlands
2. Geological Processes (Emergent Shoreline)
3. Second Mouth Estuary
4. Coastal Dunes
5. Dune Swale Wetland
6. Ventura River Estuary (Interface of Four Wetland Systems)
7. Palustrine Forested Wetlands (Riparian Woodland)
8. Transitional Riparian Scrublands and Forests
9. Estuarine and Palustrine Wetlands at Second Mouth Estuary

Botanical Resources at Emma Wood State Beach and the Ventura River Estuary: Inventory and Management.
Herbarium of the University of California, Santa Barbara 1989.

RECOMMENDATIONS

We provide a list of general recommendations that have been developed during the course of this investigation. They are presented as a guide for parties interested in the future management of natural resources and in the access and interpretative opportunities of the study area.

Reclassify Ventura River Group Camp from a "State recreational unit" to a "natural preserve" within the State park classification, per the Public Resources Code of the Department of Parks and Recreation (California State Park and Recreation Commission 1975). Information gathered during this study indicates that current recreational access is not compatible with the sensitive resources existing at the Group Camp. Better controlled access, resource protection and restoration, and enhanced educational and interpretive programs are essential if the natural resources of the study area are to be preserved and fully appreciated.

Unify the entire Ventura River Delta study area under one management authority and plan. The successful stewardship of resources and the implementation of a meaningful interpretive plan depends on the implementation of a single, aggressive plan for the Ventura River Group Camp, Seaside Wilderness Park, and the Hubbard Property. While various natural resources are unique to each parcel, the overall viability of the ecosystems depends on the environmental quality of each. A single management authority to implement the plan could include: (1) a single owner for all these parcels, (2) an interagency (inter-owner) panel consisting of representatives for each owner or regulatory agency; or (3) one management authority operating under a joint powers agreement, with conservation easements or land use agreements with owners of the other two parcels. We recommend that the California Department of Parks and Recreation be the lead agency (consistent with the policies of the City of San Buenaventura Local Coastal Program for Seaside Wilderness Park) in all three scenarios.

Implement native habitat restoration proposals. Degraded habitats, including estuarine wetlands, coastal dunes, and flood plain forests, should be evaluated for restoration potential to enhance the biological and interpretive values of the study area (See: Management Opportunities). Restoration efforts

should be coordinated with research goals and should be prioritized to include those habitats most degraded and/or threatened (e.g., estuarine wetlands at Second Mouth Estuary, dune swale wetlands, and coastal dunes).

Implement an invasive exotic vegetation control program. We recommend that control or eradication of invasive exotic weeds be undertaken while many species are not yet established throughout the study area. A prioritized list should include Giant Reed, Castor Bean, Pampas Grass, Kikuyu Grass, and Hottentot Fig, which are adversely impacting native botanical resources in the study area.

Implement a planned pedestrian access and interpretive program. Public support for conservation of resources at Ventura River Group Camp will depend on the successful implementation of a meaningful but controlled plan for access to sensitive resources, and on the development of an indepth and active interpretive program (See: Management Opportunities). We recommend that such programs be developed and implemented at the earliest possible time so that degradation of resources can be minimized and preservation and restoration plans can be coordinated with the access and interpretive programs.

Establish a Marine Ecological Reserve over the marine wetlands and deepwater habitats fronting the Ventura River Delta, as per Fish and Game Code 1580-84 (California Department of Fish and Game 1989). The marine wetlands and deepwater habitats form an integral part of the ecological systems of the study area and are subject to many of the same impacts as the terrestrial habitats. The intertidal cobble field in the study area is an example of a relatively rare habitat type in southern California. Expected increased use with the growth in population and the development of nearby access facilities must be more closely managed than general Fish and Game regulations provide, if this habitat type to maintain its natural diversity and abundance.

Revise the Vegetation, Estuary, and Wetlands boundary delineation maps in the Emma Wood State Beach General Development and Resource Management Plan (Figures 9 and 13), and the Sensitive Habitat Area and Wetland Boundary delineation (Map 12) in the City of San Buenaventura Local Control Program as provided for in LCP Sensitive Habitat Policy 5 cited above. The vegetation mapping done for these two planning programs was not based on detailed field

work and analysis utilizing standard techniques such as transects and plots or recognized vegetation classification systems. Additionally, the mapping is now ten years old, and does not reflect changes resulting from artificial disturbances and natural vegetational succession. The vegetation and habitat maps provided by this study (Appendix II, III) and any subsequent data gathered along the nine transects should be the basis for revising the planning documents.

Implement ecosystem monitoring programs. Such programs should include: (1) completion of the baseline biological inventory; (2) establishment of a comprehensive water quality monitoring program; and (3) establishment of a comprehensive biological monitoring program. Information gathered from such programs would be essential to identify functional patterns of the river delta ecosystem and any environmental problems, such as degraded water quality and impacts to sensitive species and habitats, that might threaten the biological richness or viability of the ecosystem. Success of the proposed management plan will depend on information provided by the monitoring of the resources.

Extend study of biological resources to include the western portion of Emma Wood State Beach. Important examples of marine wetlands and Coastal Bluff Scrub occur west of the Ventura River Group Camp. Biological inventories and monitoring should be conducted and management plans should be developed and implemented for this portion of the State Beach.

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APPENDIX I

CLASSIFICATION OF VEGETATED WETLANDS AND DEEPWATER HABITATS

CLASSIFICATION OF VEGETATED WETLANDS AND DEEPWATER HABITATS

The wetland plant associations listed below are arranged in a hierarchical system modified from the classification scheme of Cowardin et al. (1979). Infraspecific taxa are excluded below, but are listed in the catalogues (Appendices VI and VIII). The vegetated wetlands and deepwater habitats of the study area can be grouped into four systems, as follows: 1) the Marine System, including subtidal deepwater habitats and intertidal wetlands overlying the continental shelf and its coastline where salinities usually exceed 30 o/oo; 2) the Estuarine System, including subtidal deepwater habitats and intertidal wetlands usually confined to coastal embayments or other physiographic features that are at some point during the year open to the ocean, receive freshwater runoff, and are flooded by water with an average annual low-flow salinity (halinity) greater than 0.5 o/oo from ocean-derived salts; 3) the Riverine System includes wetlands in riverbeds or streambeds that are characterized by nonpersistent (e.g., annual) plant types when vegetated, and are flooded by water with an average low-flow salinity less than 0.5 o/oo from ocean-derived salts; and 4) the Palustrine System, including wetlands that are characterized by persistent plant types when vegetated (or if nonpersistent vegetation occurs the habitat is not a riverbed or streambed), and that are flooded by water with an average annual salinity less than 0.5 o/oo from ocean-derived salts.

Because there has been long-term and widespread disturbance in the wetlands and adjacent uplands (e.g., scraping, filling, ditching, etc.) it is difficult to apply a classification scheme to all the vegetation. Many intermediate or transitional forms of wetland vegetation result from the nature of disturbed substrates and artificial topographic features. This classification attempts to account for this variability. The species lists are not necessarily complete, but were constructed to provide examples of characteristic species.

APPENDIX I

LOWER VENTURA RIVER AND ESTUARY

CLASSIFICATION OF VEGETATED WETLANDS

SYSTEM I: Marine Wetlands and Deepwater Habitats
SUBSYSTEM: Intertidal (High)
CLASS: Rocky Shore and Aquatic Bed
SUBCLASS: Cobble and Algal
WATER REGIME: Regularly Flooded
SALINITY REGIME: Euhaline (=marine salinity)
HABITAT: Cobble Shores
EXAMPLE: Entire shoreline along Ventura River Delta
HOLLAND COMMUNITY: n.a.
COWARDIN WETLAND: Marine Aquatic Bed Wetland
CHARACTERISTIC SPECIES:

Enteromorpha spp.
Porphyra spp.
Ulva spp.

SUBSYSTEM: Intertidal (Mid)
CLASS: Rocky Shore and Aquatic Bed
SUBCLASS: Cobble and Algal
WATER REGIME: Regularly Flooded
SALINITY REGIME: Euhaline
HABITAT: Cobble Shores
EXAMPLE: Entire shoreline along Ventura River Delta
HOLLAND COMMUNITY: n.a.
COWARDIN WETLAND: Marine Aquatic Bed Wetland
CHARACTERISTIC SPECIES:

Cladophora spp.
Gelidium spp.
Gigartina spp.
Gracilaria spp.
Grateloupia spp.

SUBSYSTEM: Intertidal (Low)
CLASS: Rocky Shore and Aquatic Bed
SUBCLASS: Cobble and Algal
WATER REGIME: Regularly Flooded
SALINITY REGIME: Euhaline
HABITAT: Cobble Shores
EXAMPLE: Entire shoreline along Ventura River Delta
HOLLAND COMMUNITY: n.a.
COWARDIN WETLAND: Marine Aquatic Bed Wetland
CHARACTERISTIC SPECIES:

Bossiella spp.
Corallina spp.
Egregia menziesii
Phyllospadix spp.

SUBSYSTEM: Subtidal (Deepwater Habitat)
CLASS: Rocky Bottom and Aquatic Bed
SUBCLASS: Cobble and Algal
WATER REGIME: Subtidal
SALINITY REGIME: Euhaline
HABITAT: Cobble Bottom

EXAMPLE: Entire bottom off Ventura River Delta
HOLLAND COMMUNITY: ?
COWARDIN HABITAT: Marine Aquatic Bed Deepwater Habitat
CHARACTERISTIC SPECIES:

Egregia menziesii	*Macrocystis pyrifera*
Gelidium coulteri	*Phyllospadix* spp.

SYSTEM II: Estuarine Wetlands and Deepwater Habitats
SUBSYSTEM: Subtidal
CLASS: Aquatic Bed
SUBCLASS: Rooted Vascular
WATER REGIME: Permanently Flooded
SALINITY REGIME: Oligosaline to Mixosaline (=estuarine salinity)
HABITAT: Mud Bottom

EXAMPLE: Second Mouth Estuary of Ventura River
HOLLAND COMMUNITY: Southern Coastal Salt Marsh
COWARDIN HABITAT: Estuarine Aquatic Bed Deepwater Habitat
CHARACTERISTIC SPECIES:

Potamogeton pectinatus
Ruppia cirrhosa

SUBCLASS: Floating Vascular
WATER REGIME: Seasonally to Permanently Flooded
SALINITY REGIME: Oligosaline
HABITAT: Surface of Lagoon

EXAMPLE: Ventura River Estuary
HOLLAND COMMUNITY: ?
COWARDIN HABITAT: Estuarine Aquatic Bed Deepwater Habitat
CHARACTERISTIC SPECIES:

Azolla filiculoides
Lemna minor

SUBSYSTEM: Intertidal
CLASS: Emergent Wetland
SUBCLASS: Nonpersistent
WATER REGIME: Seasonally (Irregularly) Flooded
SALINITY REGIME: Oligosaline
HABITAT: Margins of Estuary

EXAMPLE: Exposed flats and slopes
HOLLAND COMMUNITY: Southern Coastal Salt Marsh
COWARDIN WETLAND: Estuarine Nonpersistent Emergent Wetland

CHARACTERISTIC SPECIES:

Atriplex patula	*Cotula coronopifolia*
Chenopodium macrospermum	*Spergularia marina*

SUBCLASS: Persistent

WATER REGIME I: Permanently Flooded

SALINITY REGIME: Mixosaline

HABITAT: Estuary basin

EXAMPLE: Second Mouth Estuary of Ventura River
HOLLAND COMMUNITY: Brackish Southern Coastal Salt Marsh
COWARDIN WETLAND: Estuarine Persistent Emergent Wetland
CHARACTERISTIC SPECIES:

Scirpus maritimus
Scirpus californicus

WATER REGIME II: Seasonally (Irregularly Flooded)

SALINITY REGIME I: Oligosaline

HABITAT: Margin of Estuary

EXAMPLE: Ventura River Estuary downstream from Highway 101
HOLLAND COMMUNITY: Southern Coastal Salt Marsh
COWARDIN WETLAND: Estuarine Persistent Emergent Wetland
CHACTERISTIC SPECIES:

Scirpus californicus
Typha domingensis

SALINITY REGIME II: Oligosaline to Hypersaline (?)

HABITAT:

HOLLAND COMMUNITY: Southern Coastal Salt Marsh
COWARDIN WETLAND: Estuarine Persistent Emergent Wetland
CHARACTERISTIC SPECIES:

Distichlis spicata	*Jaumea carnosa*
Euthamia occidentalis	*Salicornia virginica*
Frankenia salina	*Scirpus californicus*

CLASS: Scrub/Shrub Wetland

SUBCLASSES: Broadleaved Deciduous and Evergreen

WATER REGIME: Seasonally Flooded

SALINITY REGIME I: Oligosaline

HABITAT: Margin of Estuary

EXAMPLE: Ventura River Estuary
HOLLAND COMMUNITY: Southern Riparian Scrub
COWARDIN WETLAND: Estuarine Scrub/Shrub Wetland
CHARACTERISTIC SPECIES:

Baccharis salicifolia
Salix hindsiana
Salix lasiolepis

SALINITY REGIME II: Mixosaline

HABITAT: Margins of Salt Marsh Vegetation

EXAMPLE: Second Mouth Estuary
HOLLAND COMMUNITY: Salt Bush Scrub
COWARDIN WETLAND: Estuarine Scrub/Shrub Wetland
CHARACTERISTIC SPECIES:

Atriplex lentiformis
Salicornia virginica

SYSTEM III: Riverine Wetlands

SUBSYSTEM I: Lower Perennial

CLASS I: Aquatic Bed and Unconsolidated Bottom

SUBCLASS I: Rooted Vascular

WATER REGIME: Permanently Flooded

SALINITY REGIME: Freshwater

HABITAT: Channel Bed

EXAMPLE: Vicinity of Foster Park, upriver from study area
HOLLAND COMMUNITY: Coastal Freshwater Marsh
COWARDIN WETLAND: Riverine Aquatic Bed Wetland
CHARACTERISTIC SPECIES:

Potamogeton foliosus
Zannichellia palustris

SUBCLASS II: Floating Vascular

WATER REGIME: Seasonally/Permanently Flooded

SALINITY REGIME: Freshwater

HABITAT: Channel Bed

EXAMPLE: Vicinity of Main Street Bridge
HOLLAND COMMUNITY: Coastal Freshwater Marsh
COWARDIN WETLAND: Riverine Aquatic Bed Wetland
CHARACTERISTIC SPECIES:

Azolla filiculoides
Lemna minor

CLASS II: Unconsolidated Shore and Emergent Wetland

SUBCLASS: Nonpersistent

WATER REGIME: Seasonally Flooded

SALINITY REGIME: Freshwater

HABITAT: Exposed Channel Margins and Bed

EXAMPLE: Vicinity of Main Street Bridge
HOLLAND COMMUNITY: Coastal Freshwater Marsh
COWARDIN WETLAND: Riverine Emergent Wetland
CHARACTERISTIC SPECIES:

Artemisia biennis
Conyza canadensis
Crypsis niliaca
Gnaphalium luteo-album
Kochia scoparia
Xanthium strumarium

CLASS III: Emergent Wetland

SUBCLASS: Nonpersistent

WATER REGIME: Seasonally or Permanently Flooded or Saturated

SALINITY REGIME: Freshwater

HABITAT: Channel Margins and Bed

EXAMPLE: Vicinity of Main Street Bridge
HOLLAND COMMUNITY: Coastal Freshwater Marsh
COWARDIN WETLAND: Riverine Emergent Wetland
CHARACTERISTIC SPECIES:

Agrostis semiverticillata
Apium graveolens
Berula erecta
Cotula coronopifolia
Epilobium ciliatum
Helenium puberulum
Ludwigia uruguayensis
Persicaria spp.
Rorippa nasturtium-aquaticum
Rumex spp.
Veronica anagallis-aquatica

SYSTEM IV: Palustrine Wetlands

CLASS: Emergent Wetland

SUBCLASS: Persistent

WATER REGIME I: Seasonally Flooded

SALINITY REGIME: Freshwater

HABITAT: River Channel Margins

EXAMPLE: Upstream from Main Street Bridge
HOLLAND COMMUNITY: Coastal Freshwater Marsh
COWARDIN WETLAND: Palustrine Emergent Freshwater Wetland
CHARACTERISTIC SPECIES:

Juncus xiphoides
Scirpus californicus
Typha domingensis
Typha latifolia

WATER REGIME II: Seasonally Saturated/Flooded

SALINITY REGIME: Freshwater to Mixosaline (?)

HABITAT I: Dune Swale Wetland

EXAMPLE: Emma Wood State Beach, S. of SPRR
HOLLAND COMMUNITY: Cismontane Alkali Marsh?
COWARDIN WETLAND: Palustrine Emergent Saline Wetland
CHARACTERISTIC SPECIES:

Artemisia biennis
Conyza coulteri
Distichlis spicata
Elymus triticoides
Heliotropium curassavicum
Isocoma veneta
Salicornia virginica
Scirpus californicus
Tetragonia tetragonioides
Typha domingensis

HABITAT II: River Mouth Swale Wetland

EXAMPLE: Seaside Wilderness Park, E. of Ventura River Estuary
HOLLAND COMMUNITY: Cismontane Alkali Marsh
COWARDIN WETLAND: Palustrine Emergent Wetland
CHARACTERISTIC SPECIES:

Anemopsis californica
Pennisetum clandestinum

Baccharis douglasii
Distichlis spicata
Elymus triticoides
Jaumea carnosa
Juncus acutus
Potentilla anserina
Rumex crispus
Salicornia virginica
Scirpus californicus

CLASS: Scrub/Shrub Wetland

SUBCLASSES: Broadleaved Deciduous and Evergreen

WATER REGIME I: Seasonally Flooded

SALINITY REGIME: Freshwater

HABITAT I: River Channel Margin

EXAMPLE: Upstream from Main Street Bridge
HOLLAND COMMUNITY: Southern Riparian Scrub
COWARDIN WETLAND: Palustrine Scrub/Shrub Freshwater Wetland
CHARACTERISTIC SPECIES:

Baccharis salicifolia
Salix lasiolepis
Salix sessilifolia

HABITAT II: Exposed Riverbed and Bars

EXAMPLE: Downstream from Main Street Bridge
HOLLAND COMMUNITY: Southern Riparian Scrub
COWARDIN WETLAND: Palustrine Scrub/Shrub Freshwater Wetland
CHARACTERISTIC SPECIES:

Baccharis salicifolia
Lepidospartum squamatum
Salix lasiolepis
Salix sessilifolia

WATER REGIME II: Seasonally Saturated, Temporarily Flooded, Phreatophytic

SALINITY REGIME: Freshwater to Mixosaline (?)

HABITAT: Cobble Beach and Dune Swale Wetland

EXAMPLE: Emma Wood State Beach
HOLLAND COMMUNITY: Salt Bush Scrub
COWARDIN WETLAND: Palustrine Scrub/Shrub Saline Wetland
CHARACTERISTIC SPECIES:

Atriplex californica
Atriplex lentiformis
Atriplex semibaccata
Baccharis pilularis
Baccharis salicifolia
Isocoma veneta
Toxicodendron diversilobum
Tetragonia tetragonioides

WATER REGIME III: Phreatophytic (?)/Transitional Upland (?)

SALINITY REGIME: Freshwater

HABITAT I: Flood Plain

EXAMPLES: Downstream from Main Street Bridge
HOLLAND COMMUNITY: Southern Riparian Scrub
COWARDIN WETLAND: Palustrine Scrub/Shrub Freshwater Wetland

CHARACTERISTIC SPECIES: (Mixed Scrub)

Artemisia californica
Atriplex lentiformis
Baccharis pilularis
Ceanothus oliganthus
Salix lasiolepis
Salvia mellifera
Toxicodendron diversilobum

HABITAT II: Abandoned Temporary Channels/Transitional Upland (?)

EXAMPLES: Emma Wood State Beach, South of Highway 101
HOLLAND COMMUNITY: Southern Riparian Scrub
COWARDIN WETLAND: Palustrine Scrub/Shrub Freshwater Wetland
CHARACTERISTIC SPECIES:

Atriplex lentiformis
Baccharis pilularis
Baccharis salicifolia
Isocoma veneta
Salix hindsiana
Salix lasiolepis
Toxicodendron diversilobum

CLASS: Forested Wetland
SUBCLASS: Broadleaved Deciduous
WATER REGIME I: Seasonally Flooded
SALINITY REGIME: Freshwater
HABITAT I: River Channel Margin

EXAMPLE: Downstream from Main Street
HOLLAND COMMUNITY: Southern Arroyo Willow Riparian Forest
COWARDIN WETLAND: Palustrine Forested Wetland
CHARACTERISTIC SPECIES:

Alnus rhombifolia
Salix laevigata
Salix lasiandra
Salix lasiolepis

HABITAT II: Exposed River Bed

EXAMPLE: Downstream from Highway 101, E. side
HOLLAND COMMUNITY: Southern Arroyo Willow Riparian Woodland and Forest
COWARDIN WETLAND: Palustrine Forested Wetland
CHARACTERISTIC SPECIES:

Salix lasiolepis

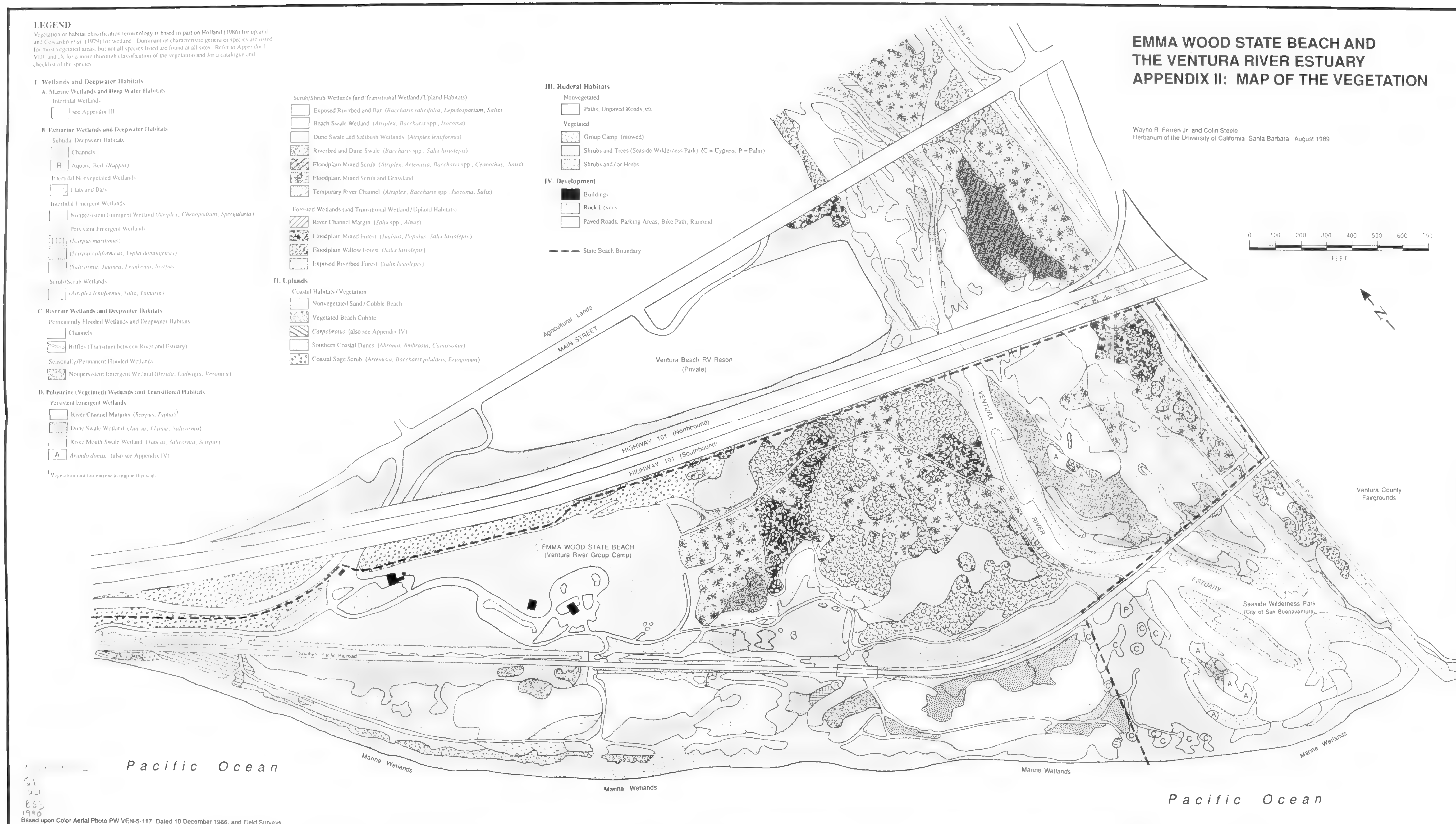
WATER REGIME II: Phreatophytic/Transitional Upland (?)
SALINITY REGIME: Freshwater
HABITAT: Flood Plain

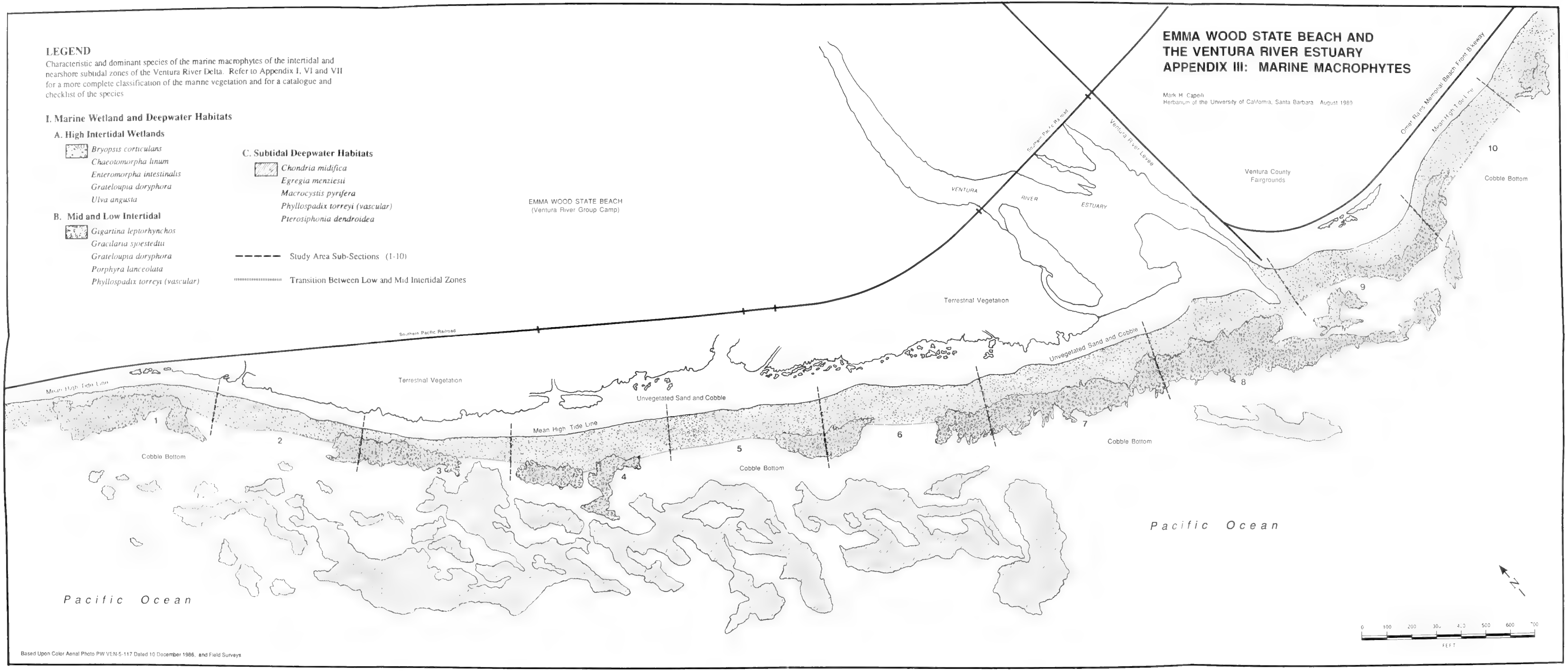
EXAMPLE: Emma Wood State Beach
HOLLAND COMMUNITY: Southern Cottonwood Riparian Forest
Southern Arroyo Willow Riparian Forest
COWARDIN WETLAND: Palustrine Forested Wetland
CHARACTERISTIC SPECIES I:

Clematis ligusticifolia	*Rubus ursinus*
Juglans californica	*Salix lasiolepis*
Populus trichocarpa	*Toxicodendron diversilobum*

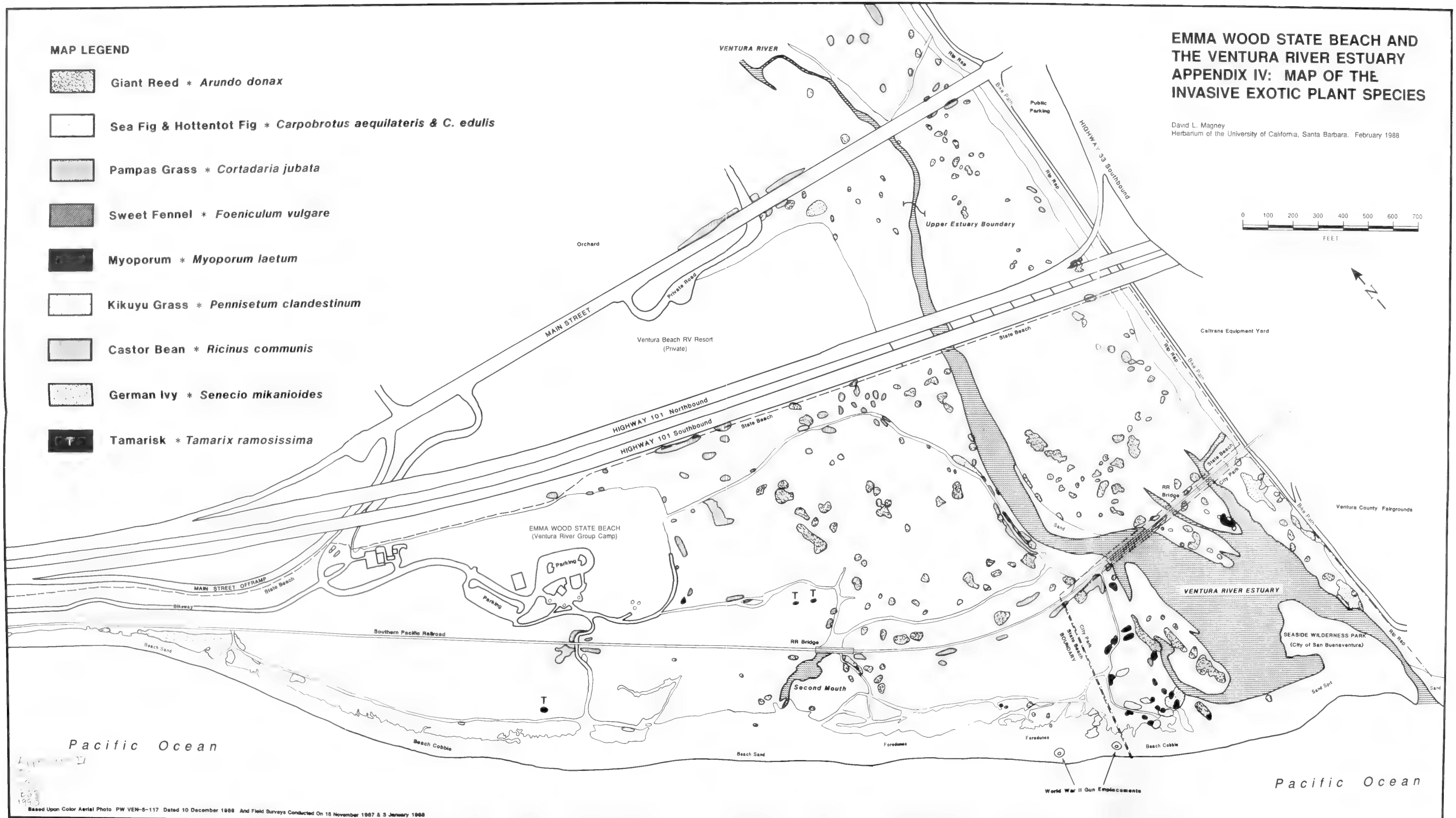
CHARACTERISTIC SPECIES II:

Clematis ligusticifolia	*Salix lasiolepis*
Rubus ursinus	*Toxicodendron diversilobum*


EMMA WOOD STATE BEACH AND
THE VENTURA RIVER ESTUARY
APPENDIX II: MAP OF THE VEGETATION
Wayne R. Ferren Jr. and Colin Steele
Herbarium of the University of California, Santa Barbara August 1989
LEGEND
Vegetation or habitat classification terminology is based in part on Holland (1986) for upland and Cowardin et al. (1979) for wetland. Dominant or characteristic genera or species are listed for most vegetated areas, but not all species listed are found at all sites. Refer to Appendix I, VIII, and IX for a more thorough classification of the vegetation and for a catalogue and checklist of the species.
I. Wetlands and Deepwater Habitats
A. Marine Wetlands and Deep Water Habitats
Intertidal Wetlands
see Appendix III
B. Estuarine Wetlands and Deepwater Habitats
Subtidal Deepwater Habitats
Channels
R Aquatic Bed (Ruppia)
Intertidal Nonvegetated Wetlands
Flats and Bars
Intertidal Emergent Wetlands
Nonpersistent Emergent Wetland (Atriplex, Chenopodium, Spergularia)
Persistent Emergent Wetlands
(Scirpus maritimus)
(Scirpus californicus, Typha domingensis)
(Salicornia, Jaumea, Frankenia, Scirpus
Scrub/Scrub Wetlands
(Atriplex lentiformis, Salix, Tamarix)
C. Riverine Wetlands and Deepwater Habitats
Permanently Flooded Wetlands and Deepwater Habitats
Channels
Riffles (Transition between River and Estuary)
Seasonally/Permanent Flooded Wetlands
Nonpersistent Emergent Wetland (Berula, Ludwigia, Veronica)
D. Palustrine (Vegetated) Wetlands and Transitional Habitats
Persistent Emergent Wetlands
River Channel Margins (Scirpus, Typha)[1]
Dune Swale Wetland (Juncus, Elymus, Salicornia)
River Mouth Swale Wetland (Juncus, Salicornia, Scirpus)
A Arundo donax (also see Appendix IV)
[1] Vegetation unit too narrow to map at this scale
Scrub/Shrub Wetlands (and Transitional Wetland/Upland Habitats)
Exposed Riverbed and Bar (Baccharis salicifolia, Lepidospartum, Salix)
Beach Swale Wetland (Atriplex, Baccharis spp., Isocoma)
Dune Swale and Saltbush Wetlands (Atriplex lentiformis)
Riverbed and Dune Swale (Baccharis spp., Salix lasiolepis)
Floodplain Mixed Scrub (Atriplex, Artemisia, Baccharis spp., Ceanothus, Salix)
Floodplain Mixed Scrub and Grassland
Temporary River Channel (Atriplex, Baccharis spp., Isocoma, Salix)
Forested Wetlands (and Transitional Wetland/Upland Habitats)
River Channel Margin (Salix spp., Alnus)
Floodplain Mixed Forest (Juglans, Populus, Salix lasiolepis)
Floodplain Willow Forest (Salix lasiolepis)
Exposed Riverbed Forest (Salix lasiolepis)
II. Uplands
Coastal Habitats/Vegetation
Nonvegetated Sand/Cobble Beach
Vegetated Beach Cobble
Carpobrotus (also see Appendix IV)
Southern Coastal Dunes (Abronia, Ambrosia, Camissonia)
Coastal Sage Scrub (Artemisia, Baccharis pilularis, Eriogonum)
III. Ruderal Habitats
Nonvegetated
Paths, Unpaved Roads, etc
Vegetated
Group Camp (mowed)
Shrubs and Trees (Seaside Wilderness Park) (C = Cypress, P = Palm)
Shrubs and/or Herbs
IV. Development
Buildings
Rock Levees
Paved Roads, Parking Areas, Bike Path, Railroad
State Beach Boundary
0 100 200 300 400 500 600 700
FEET
N
Agricultural Lands
MAIN STREET
Ventura Beach RV Resort
(Private)
HIGHWAY 101 (Northbound)
HIGHWAY 101 (Southbound)
VENTURA
RIVER
Bike Path
EMMA WOOD STATE BEACH
(Ventura River Group Camp)
Southern Pacific Railroad
ESTUARY
Seaside Wilderness Park
(City of San Buenaventura)
Ventura County
Fairgrounds
Marine Wetlands
Marine Wetlands
Marine Wetlands
Marine Wetlands
Pacific Ocean
Pacific Ocean
Based upon Color Aerial Photo PW VEN-5-117 Dated 10 December 1986, and Field Surveys



EMMA WOOD STATE BEACH AND
THE VENTURA RIVER ESTUARY
APPENDIX III: MARINE MACROPHYTES
Mark H. Capelli
Herbarium of the University of California, Santa Barbara August 1989
LEGEND
Characteristic and dominant species of the marine macrophytes of the intertidal and nearshore subtidal zones of the Ventura River Delta. Refer to Appendix I, VI and VII for a more complete classification of the marine vegetation and for a catalogue and checklist of the species
I. Marine Wetland and Deepwater Habitats
A. High Intertidal Wetlands
Bryopsis corticulans
Chaetomorpha linum
Enteromorpha intestinalis
Grateloupia doryphora
Ulva angusta
B. Mid and Low Intertidal
Gigartina leptorhynchos
Gracilaria sjoestedtii
Grateloupia doryphora
Porphyra lanceolata
Phyllospadix torreyi (vascular)
C. Subtidal Deepwater Habitats
Chondria nidifica
Egregia menziesii
Macrocystis pyrifera
Phyllospadix torreyi (vascular)
Pterosiphonia dendroidea
Study Area Sub-Sections (1-10)
Transition Between Low and Mid Intertidal Zones
EMMA WOOD STATE BEACH
(Ventura River Group Camp)
Southern Pacific Railroad
Ventura River Levee
VENTURA RIVER ESTUARY
Ventura County
Fairgrounds
Omer Rains Memorial Beach Front Bikeway
Mean High Tide Line
Terrestrial Vegetation
Unvegetated Sand and Cobble
Cobble Bottom
Pacific Ocean
1
2
3
4
5
6
7
8
9
10
N
0 100 200 300 400 500 600 700
FEET
Based Upon Color Aerial Photo PW VEN-5-117 Dated 10 December 1986, and Field Surveys



EMMA WOOD STATE BEACH AND
THE VENTURA RIVER ESTUARY
APPENDIX IV: MAP OF THE
INVASIVE EXOTIC PLANT SPECIES
David L. Magney
Herbarium of the University of California, Santa Barbara. February 1988
MAP LEGEND
Giant Reed * Arundo donax
Sea Fig & Hottentot Fig * Carpobrotus aequilateris & C. edulis
Pampas Grass * Cortadaria jubata
Sweet Fennel * Foeniculum vulgare
Myoporum * Myoporum laetum
Kikuyu Grass * Pennisetum clandestinum
Castor Bean * Ricinus communis
German Ivy * Senecio mikanioides
Tamarisk * Tamarix ramosissima
0 100 200 300 400 500 600 700
FEET
N
VENTURA RIVER
Rip Rap
Bike Path
Public Parking
HIGHWAY 33 Southbound
Upper Estuary Boundary
Orchard
Private Road
MAIN STREET
Ventura Beach RV Resort
(Private)
State Beach
Caltrans Equipment Yard
HIGHWAY 101 Northbound
HIGHWAY 101 Southbound
EMMA WOOD STATE BEACH
(Ventura River Group Camp)
Parking
MAIN STREET OFFRAMP
Bikeway
Southern Pacific Railroad
Beach Sand
RR Bridge
Second Mouth
City Park
State Beach
BOUNDARY
VENTURA RIVER ESTUARY
SEASIDE WILDERNESS PARK
(City of San Buenaventura)
Ventura County Fairgrounds
Sand
Sand Spit
Foredunes
Beach Cobble
Pacific Ocean
World War II Gun Emplacements
Pacific Ocean
Based Upon Color Aerial Photo PW VEN-5-117 Dated 10 December 1986 And Field Surveys Conducted On 15 November 1987 & 3 January 1988

APPENDIX V

QUANTITATIVE VEGETATION ANALYSIS:
TABLES AND FIGURES

TABLE V-1. Species List and Numbers for Transects and Plots of Ventura River Mouth, Aug.-Sep. 1988.

Species Number	Scientific Name	Common Name
1	*Abronia umbellata*	Sand Verbena
2	*Alnus rhombifolia*	White Alder
3	*Ambrosia chamissonis* ssp. *bipinnatisecta*	Beach-bur
4	*Ambrosia psilostachya* var. *californica*	Western Ragweed
5	*Anagallis arvensis*	Scarlet Pimpernel
6	*Apium graveolens*	Celery
7	*Artemisia biennis*	Marsh Sagebrush
8	*Artemisia californica*	California Sagebrush
9	*Artemisia douglasiana*	Mugwort
10	*Arundo donax*	Giant Reed
11	*Aster subulatus* ssp. *ligulata*	Slender Marsh Aster
12	*Astragalus trichopodus* ssp. *trichopodus*	Southern California Locoweed
13	*Atriplex californica*	California Saltbush
14	*Atriplex lentiformis* var. *breweri*	Brewer Saltbrush
15	*Atriplex leucophylla*	Whiteleaf Saltbush
16	*Atriplex patula*	Spear-leaved Saltbrush
17	*Atriplex semibaccata*	Australian Saltbrush
18	*Avena* sp.	Wild Oat
19	*Baccharis douglasii*	Marsh Baccharis
20	*Baccharis pilularis* ssp. *consanguinea*	Coyote Brush
21	*Baccharis salicifolia*	Mule Fat
22	*Bassia hyssopifolia*	Fivehook
23	*Brachypodium distachyon*	Grass
24	*Brassica geniculata*	Summer Mustard
25	*Bromus diandrus*	Ripgut Grass
26	*Bromus hordeaceus*	Soft Chess
27	*Bromus rubens*	Red Brome
28	*Cakile maritima*	Sea Rocket
29	*Calystegia macrostegia*	Morning Glory
30	*Calystegia soldanella*	Beach Morning Glory
31	*Camissonia cheiranthifolia* ssp. *suffruticosa*	Beach Evening Primrose
32	*Cardaria draba* var. *draba*	Hoary Cress
33	*Carduus pycnocephalus*	Italian Thistle
34	*Carpobrotus edulis*	Hottentot Fig
35	*Centaurea melitensis*	Tocalote
36	*Chenopodium macrospermum* var. *farinosum*	Goosefoot
37	*Clematis ligusticifolia*	Virgin's Bower
38	*Conium maculatum*	Poison Hemlock
39	*Conyza canadensis*	Common Horseweed
40	*Cortaderia jubata*	Pampas Grass

TABLE V-1. (Continued)

Species Number	Scientific Name	Common Name
41	*Cotula coronopifolia*	Brass Buttons
42	*Cuscuta ceanothi*	Chaparral Dodder
43	*Cynodon dactylon*	Bermuda Grass
44	*Cyperus eragrostis*	Tall Umbrella Sedge
45	*Datura wrightii*	Jimson Weed
46	*Distichlis spicata*	Saltgrass
47	*Elymus condensatus*	Giant Rye
48	*Epilobium ciliatum* ssp *ciliatum*	Northern Willow-herb
49	*Eriogonum parvifolium*	Seacliff Buckwheat
50	*Eriophyllum confertiflorum*	Golden Yarrow
51	*Euphorbia lathyris*	Caper Spurge
52	*Filago californica*	California Filago
53	*Foeniculum vulgare*	Sweet Fennel
54	*Frankenia salina*	Alkali Heath
55	*Gnaphalium californicum*	Green Everlasting
56	*Gnaphalium luteo-album*	Cudweed Everlasting
57	*Gnaphalium microcephalum*	Everlasting
58	*Heliotropium curassavicum* var. *oculatum*	Chinese pusley
59	*Heterotheca grandiflora*	Telegraph Weed
60	*Isocoma veneta* ssp *vernonioides*	Coastal Goldenbush
61	*Jaumea carnosa*	Fleshy Jaumea
62	*Juglans californica*	California Black Walnut
63	*Juncus textilis*	Basket Rush
64	*Lactuca serriola*	Prickly Lettuce
65	*Lemna minor*	Duckweed
66	*Lepidium lasiocarpum*	Spectacle Pod
67	*Lepidospartum squamatum*	Scale Broom
68	*Lolium multiflorum*	Italian Ryegrass
69	*Lotus scoparius*	Deerweed
70	*Ludwigia uruguayensis*	Water Primrose
71	*Malacothrix saxatilis* ssp. *tenuifolia*	Coastal Cliff-aster
72	*Malosma laurina*	Laurel-leaf Sumac
73	*Marah fabaceus* var *agrestis*	California Manroot
74	*Marrubium vulgare*	Horehound
75	*Melilotus albus*	White Sweetclover
76	*Nicotiana glauca*	Tree Tobacco
77	*Oryzopsis miliacea*	Rice Grass
78	*Phacelia ramosissima*	Phacelia
79	*Picris echioides*	Bristly Ox Tongue
80	*Plantago lanceolata*	Narrowleaf Plantain

TABLE V-1. (Continued)

Species Number	Scientific Name	Common Name
81	*Plantago major*	Broadleaf Plantain
82	*Persicaria punctata*	Dotted Knotweed
83	*Polypogon monspeliensis*	Rabbitfoot Grass
84	*Populus alba*	Poplar
85	*Potentilla egedii*	Marsh Cinquefoil
86	*Rhus integrifolia*	Sugar Bush
87	*Ricinus communis*	Castor Bean
88	*Rubus ursinus*	California Blackberry
89	*Rumex crispus*	Curly Dock
90	*Rumex* sp.	Dock
91	*Ruppia cirrhosa*	Ditch Grass
92	*Salix laevigata*	Red Willow
93	*Salix lasiandra*	Yellow Willow
94	*Salix lasiolepis*	Arroyo Willow
95	*Salix sessilifolia*	Sandbar Willow
96	*Salsola australis*	Russian Thistle
97	*Salvia leucophylla*	Purple Sage
98	*Salicornia virginica*	Pickleweed
99	*Scirpus californicus*	California Bulrush
100	*Scirpus maritimus*	Saltmarsh Bulrush
101	*Scirpus pungens*	Three Square
102	*Scirpus* sp	Bulrush
103	*Scrophularia californica*	California Figwort
104	*Senecio mikanioides*	German-ivy
105	*Solanum americanum*	Nightshade
106	*Solanum xantii*	Purple Nightshade
107	*Solanum* sp	Nightshade
108	*Euthamia (Solidago) occidentalis*	Western Goldenrod
109	*Sonchus asper*	Prickly Sow-thistle
110	*Spergularia marina*	Marsh Spurry
111	*Tetragonia tetragonioides*	New Zealand Spinach
112	*Toxicodendron diversilobum*	Poison Oak
113	*Typha domingensis*	Narrowleaf Cattail
114	*Urtica dioica* ssp *gracilis* var *holosericea*	Giant Creek Nettle
115	*Verbena lasiostachys*	Hairy-spike Verbena
116	*Vulpia myuros*	Foxtail Fescue
117	*Xanthium strumarium*	Cocklebur
118		Bare ground/trail/upper river bed
119		Beach/lower river mouth sand
120		Rocks/riprap/cobbles/berm
121		Water

TABLE V-2. Ventura River Delta Plot/Species Data and TWINSPAN Classification, including Nonvegetated Cagetories but Excluding Rare Species. Groups derived from the TWINSPAN classification were used to identify associations (clusters) on the DECORANA scatterplots. Frequency values (1-7) for species in 49 plots are: 1 = 0-1% cover value; 2 = 2-4%; 3 = 5-9%; 4 = 10-24%; 5 = 25-49%; 6 = 50-74%; 7 = 75-100%. Hierarchy at right of table shows species classification by TWINSPAN. Hierarchy below the table shows plot classification by TWINSPAN.

PLOTS

SPECIES

```
               12331133 2 14  444224244222223333 331   114 11144
               4101892310354263124598786927345679890478120537656

111 TETR TETR  5----------1-------------------------------2-----  0000
 10 ARUN DONA  -2--54-7-1---------1------32---1--2--------------  00010
 84 POPU ALBA  -365---------------------------------------------  000110
 38 CONI MACU  2--3-33-43-1-1------------1----------------------  000110
112 TOXI DIVE  2-772-5755----2-1--------------------------------  000110
 37 CLEM LIGU  ----3-5--1---------------------------------------  000110
104 SENE MIKA  ----77-------------------------------------------  000110
 87 RICI COMM  1----4-------------3-----------------------------  000111
 94 SALI LASO  -75456772----4----42-21275554---------2----------  00100
 14 ATRI LENT  1---2---5476767524354-1------131-1-------12------  01000
 20 BACC PILU  -----2--54---33555-----111-----------------------  01001
 32 CARD DRAB  ----------45-------------------------------------  01001
 21 BACC SALI  -5--24-1-5-----43442-33445243----12-------2------  01010
 92 SALI LAEV  -3------------------------64---------------------  01010
  8 ARTE CALI  ---------1------1-446-11-1-----------------------  010110
 33 CARD PYCN  ------------------232--1-------------------------  010110
 24 BRAS GENI  -----4---2-------2554233-2-12--------------------  010110
 35 CENT MELI  ------------------413111-1-1---------------------  010110
 39 CONY CANA  ---------------------131-1-11--------------------  010111
 53 FOEN VULG  ----------------221-1333-1-11--------------------  010111
 67 LEPI SQUA  ------------------1-2212-------------------------  010111
 75 MELI ALBU  ------------------2--56342-12-1------------------  010111
 77 ORYZ MILI  -1----------------1-12311-12---------------------  010111
  4 AMBR PSIL  ----------------22----11---11-1------------------  010111
118 BARE GRND  -1------3-44---34-332545243-4--------------------  010111
 25 BROM DIAN  ---1-------------45-----------------------2---1--  01100
 83 POLY MONS  ----------------2111-1-111-1122-----------2------  01100
 60 ISOC VENE  ----------------33----------------------------121  0111
 43 CYNO DACT  -----------------11--1-13--3-251-----------------  100
120 ROCK COBB  ---------------------5452--4---45----------744---  101
 58 HELI CURV  ----------1---32-----------------2----12-1-2-----  1100
108 EUTH OCCI  --------------53-1---------------1----43--1------  1100
 46 DIST SPIC  -----------------------------------1-15-4671--111  110100
 61 JAUM CARN  ---------------4-----------------4-24-74656------  110101
 98 SALI VIRG  -----------------1------------------47576221-----  110101
100 SCIR MARI  ------------------------------------7-13411------  110101
 99 SCIR CALI  ---------------3-----------------577--24---------  110101
  7 ARTE BIEN  ----------------------------1-21-4----16---------  110101
121 WATE R     -----------------------------3-44---5------------  110110
 16 ATRI PATU  ----------------------------17465-25------2------  110110
 36 CHEN MACR  -----------------------------4-43-11-------------  110110
 41 COTU CORO  -----------------------------2521----------------  110110
110 SPER MARI  -----------------------------6523----------------  110110
113 TYPH DOMI  ----------------------------3-2--14---1----------  110111
 28 CAKI MARI  -------------------------------1--2------2-213-21  1110
119 BECH SAND  -------------------------------4---2-2--26--66665  1110
 34 CARP EDUL  --------------------------------------------22113  111100
  1 ABRO UMBE  --------------------------------------------1-354  111101
 31 CAMI CHEI  ----------------------------------------------432  111101
  3 AMBR CHAM  -----------------------------------------1-244434  11111

               0000000000000000000000000000011111111111111111111
               0000000000111111111111111111100000000000000111111
               0111111111000000111111111111100001111111111011111
                0001111110001110000011111111    0001111111 00111
                   000011      0011100000001       0000011
                                    0000011        01111
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TABLE V-3. Ventura River Delta Plot/Species Data and TWINSPAN Classification, including Nonvegetated Categories and Rare Species. Groups derived from the TWINSPAN classification were used to identify associations (clusters) on the DECORANA scatterplots. Frequency values (1-7) for species in 49 plots are: 1 = 0-1% cover value; 2 = 2-4%; 3 = 5-9%; 4= 10-24%; 5 = 25-49%; 6 = 50-74%; 7 = 75-100%. Hierarchy at right of table shows species classification by TWINSPAN. Hierarchy below the table shows plot classification by TWINSPAN.

PLOTS

SPECIES

		12331133 2 14 444224244222223333 331 114 11144	
		4101892310354263124598786927345679890478120537656	
111	TETR TETR	5----------1-------------------------------2-----	0000
10	ARUN DONA	-2--54-7-1---------1------32---1--2--------------	00010
42	CUSC CEAN	--41---1---	000110
62	JUGL CALI	---5---	000110
63	JUNC TEXT	7--	000110
73	MARA FABA	---3---	000110
84	POPU ALBA	-365---	000110
86	RHUS OVAT	-2---	000110
95	SALI SESS	-2---	000110
38	CONI MACU	2--3-33-43-1-1------------1----------------------	000110
106	SOLA XANT	--------1--	000110
112	TOXI DIVE	2-772-5755----2-1--------------------------------	000110
37	CLEM LIGU	----3-5--1---------------------------------------	000110
45	DATU METE	-----1---	000110
88	RUBU URSI	----2--31--	000110
104	SENE MIKA	----77---	000110
103	SCRO CALI	------12-1--------1------------------------------	000110
72	MALO LAUR	----4----------------11--------------------------	000111
87	RICI COMM	1----4-------------3-----------------------------	000111
55	GNAP CALI	1------------------------1-----------------------	00100
76	NICO GLAU	-----3-------------1--1--------------------------	00100
94	SALI LASO	-75456772----4----42-21275554---------2----------	00100
105	SOLA NODI	-------1--------------------1--------------------	00100
47	ELYM COND	----4------3-------------------------------------	00101
51	EUPH LATH	1-------1---11-----------------------------------	00101
74	MARR VULG	1-------1---------11-------1---------------------	0011
14	ATRI LENT	1---2---5476767524354-1------131-1-------12------	01000
19	BACC DOUG	--------1----2---------1----1--------------------	01001
20	BACC PILU	-----2--54---33555-----111-----------------------	01001
32	CARD DRAB	----------45-------------------------------------	01001
66	LEPI LASI	---------------1---------------------------------	01001
9	ARTE DOUG	----2-------------2---1--1-1---------------------	01010
21	BACC SALI	-5--24-1-5-----43442-33445243----12-------2------	01010
92	SALI LAEV	-3------------------------64---------------------	01010
5	ANAG ARVE	--------1---------114----------------------------	010110
8	ARTE CALI	---------1------1-446-11-1-----------------------	010110
18	AVEN SP.	--------------------1----------------------------	010110
33	CARD PYCN	------------------232--1-------------------------	010110
116	VULP MEGA	------------------32---1-------------------------	010110
26	BROM HORD	----------------31----1--------------------------	010110
59	HETE GRAN	------------------2---1--------------------------	010110
24	BRAS GENI	-----4---2--------2554233-2-12-------------------	010110
35	CENT MELI	------------------413111-1-1---------------------	010110
2	ALNU RHOM	------------------------2------------------------	010111
6	APIU GRAV	----------------------------1--------------------	010111
12	ASTR TRIC	-----------------------1-------------------------	010111
23	BRAC DIST	---------------------------1---------------------	010111
27	BROM RUBE	----------------2----111---1---------------------	010111
29	CALY MACR	---------------------1---------------------------	010111
39	CONY CANA	---------------------131-1-11--------------------	010111
44	CYPE ERAG	----------------------------1--------------------	010111
48	EPIL CILI	--------------------------1-1--------------------	010111
49	ERIO PARV	---------------------1---------------------------	010111
50	ERIO CONF	-------------------------1-----------------------	010111
52	FILA CALI	-----------------------1-------------------------	010111
53	FOEN VULG	----------------221-1333-1-11--------------------	010111
56	GNAP LUTE	----------------------11-1-----------------------	010111
57	GNAP MICR	---------------------1-1-------------------------	010111
64	LACT SERR	---------------------11---11---------------------	010111
65	LEMN MINO	----------------------------1--------------------	010111

TABLE V-3. (Continued)

PLOTS

SPECIES

```
 67 LEPI SQUA  ------------------1-2212--------------------------  010111
 69 LOTU SCOP  ---------------------221--------------------------  010111
 70 LUDW URUG  ----------------------------5---------------------  010111
 71 MALA SAXA  -------------------------1------------------------  010111
 75 MELI ALBU  ------------------2--56342-12-1-------------------  010111
 77 ORYZ MILI  -1----------------1-12311-12----------------------  010111
 82 PERS PUNC  ----------------------------2---------------------  010111
 93 SALI LASI  ------------------------2---5---------------------  010111
 97 SALV LEUC  -----------------------2--------------------------  010111
114 URTI DIOI  ----------------------------1---------------------  010111
115 VERB LASI  ----------------------1---1-----------------------  010111
  4 AMBR PSIL  ----------------22----11---11-1-------------------  010111
118 BARE GRND  -1------3-44---34-332545243-4---------------------  010111
 25 BROM DIAN  ---1-------------45------------------------2---1--  01100
 83 POLY MONS  ----------------2111-1-111-1122------------2------  01100
109 SONC ASPE  ------------------1--------11---------------1-----  01100
117 XANT STRU  ------------------1---1-----2-1------------1------  01100
 80 PLAN LANC  ---------------------111------1------------1------  01101
 60 ISOC VENE  ----------------33-----------------------------121  0111
 11 ASTE SUBU  ----------------------------1--------------1------  100
 43 CYNO DACT  -----------------11--1-13--3-251------------------  100
 79 PICR ECHI  ----------------------------2-2-------------------  100
 78 PHAC RAMO  ---------------------------1---------------------1  101
120 ROCK COBB  ---------------------5452--4---45-----------744---  101
 58 HELI CURV  ----------1---32------------------2----12-1-2-----  1100
108 EUTH OCCI  --------------53-1----------------1----43--1------  1100
 46 DIST SPIC  ------------------------------------1-15-4671--111  110100
 54 FRAN SALI  --------------------------------------411---1-----  110100
 68 LOLI MULT  -------------------------------------------2------  110100
101 SCIR PUNG  ------------------------------------------1-------  110100
 13 ATRI CALI  --------------------------------------1-----------  110101
 61 JAUM CARN  ---------------4------------------4-24-74656------  110101
 91 RUPP CIRR  -------------------------------------4---1--------  110101
 98 SALI VIRG  -----------------1-------------------47576221-----  110101
100 SCIR MARI  -------------------------------------7-13411------  110101
 99 SCIR CALI  ---------------3------------------577--24---------  110101
  7 ARTE BIEN  -----------------------------1-21-4----16---------  110101
 22 BASS HYSS  --------------------------------1---------1-------  110110
 89 RUME CRIS  -------------------------------1-----------1------  110110
121 WATE R     ------------------------------3-44---5------------  110110
 16 ATRI PATU  -----------------------------17465-25------2------  110110
 36 CHEN MACR  ------------------------------4-43-11-------------  110110
 41 COTU CORO  ------------------------------2521----------------  110110
 81 PLAN MAJO  -------------------------------1------------------  110110
110 SPER MARI  ------------------------------6523----------------  110110
 40 CORT JUBA  ----------------------------------2---------------  110110
102 SCIR  SP.  -----------------------------------1--------------  110110
113 TYPH DOMI  -----------------------------3-2--14---1----------  110111
 28 CAKI MARI  --------------------------------1--2------2-213-21  1110
119 BECH SAND  --------------------------------4---2-2--26--66665  1110
 15 ATRI LEUC  ---------------------------------------------1----  111100
 30 CALY SOLD  ----------------------------------------------11--  111100
 34 CARP EDUL  ---------------------------------------------22113  111100
  1 ABRO UMBE  ---------------------------------------------1-354  111101
 31 CAMI CHEI  -----------------------------------------------432  111101
  3 AMBR CHAM  ------------------------------------------1-244434  11111
 17 ATRI SEMI  --------------------------------------------1-1---  11111
 96 SALS AUST  --------------------------------------------1-----  11111

               00000000000000000000000000000111111111111111111111
               00000000001111111111111111111000000000000000111111
               01111111110000001111111111111000011111111111011111
                0001111110001110000011111111    00011111111 00111
                   000011      0011100000001       0000011
                                    0000011        01111
```

TABLE V-4. Ventura River Delta Plot/Species Data and TWINSPAN Classification, excluding Nonvegetated Categories and Rare Species. Groups derived from the TWINSPAN classification were used to identify associations (clusters) on the DECORANA scatterplots. Frequency values (1-7) for species in 49 plots are: 1 = 0-1% cover value; 2 = 2-4%; 3 = 5-9%; 4 = 10-24%; 5 = 25-49%; 6 = 50-74%; 7 = 75-100%. Hierarchy at right of table shows species classifications by TWINSPAN. Hierarchy below the table shows plots classification by TWINSPAN.

PLOTS

SPECIES

```
                   1 1  4333 211322442242442222  411 14333333 11144
                   4352640121089312124598786793893017208945675376564

 25 BROM DIAN      -------1---------45----------------2---------1---   0000
 21 BACC SALI      ----------5241523442-3344453-14----22------------   000100
 83 POLY MONS      ----------------2111-1-11111-------2--22---------   000100
 39 CONY CANA      ---------------------131-111---------------------   000101
 53 FOEN VULG      ----------------221-1333-111---------------------   000101
 67 LEPI SQUA      ------------------1-2212-------------------------   000101
 75 MELI ALBU      ------------------2--5634122-----------1---------   000101
 77 ORYZ MILI      --------------11--1-123112-----------------------   000101
  4 AMBR PSIL      ----------------22----11-1-1-----------1---------   000101
  5 ANAG ARVE      ---------1--------114----------------------------   000101
  8 ARTE CALI      ----------1-----1-446-11--1----------------------   000101
  9 ARTE DOUG      -----------2------2---1--11----------------------   000101
 24 BRAS GENI      ----------2-4----2554233-122---------------------   000101
 33 CARD PYCN      ------------------232--1-------------------------   000101
 35 CENT MELI      ------------------413111-11----------------------   000101
 10 ARUN DONA      ----------154723---1-----2----------2---1--------   000101
 87 RICI COMM      1-----------4------3-----------------------------   000101
 92 SALI LAEV      --------------36---------4-----------------------   000101
104 SENE MIKA      -----------77------------------------------------   000101
 94 SALI LASO      ---4--5472-56775--42-2127554-----2---------------   000101
 47 ELYM COND      --3--------4-------------------------------------   000110
 37 CLEM LIGU      --------5-13-------------------------------------   000110
 38 CONI MACU      2-11---3343-3--1---------------------------------   000110
 84 POPU ALBA      ------65------3----------------------------------   000110
112 TOXI DIVE      2---2-775552-7--1--------------------------------   000110
 32 CARD DRAB      -45----------------------------------------------   000110
 14 ATRI LENT      176677---542----24354-1------15---12--131--------   000111
 20 BACC PILU      ---33----54-2---55-----11-1---5------------------   000111
 43 CYNO DACT      -----------------11--1-133------------251--------   0010
108 EUTH OCCI      ----5------------1----------313--4-1-------------   001100
 61 JAUM CARN      ----------------------------44446756-2-----------   001101
100 SCIR MARI      ----------------------------3--74111-------------   001101
  7 ARTE BIEN      ---------------------------164---1-----21--------   001110
 99 SCIR CALI      ----------------------------453--2--77-----------   001110
 16 ATRI PATU      ---------------------------1-------2257465-------   001111
 36 CHEN MACR      ------------------------------------114-43-------   001111
 41 COTU CORO      --------------------------------------2521-------   001111
110 SPER MARI      --------------------------------------6523-------   001111
113 TYPH DOMI      ---------------------------3-1---1--4--2---------   001111
 58 HELI CURV      -1--3-----------------------222--11-------2------   01
 98 SALI VIRG      -----------------1----------7--46522------1-----7   01
111 TETR TETR      5-1---------------------------------------2------   01
 60 ISOC VENE      ----------------33---------------------------121-   100
  3 AMBR CHAM      ----------------------------------1-------244434-   101011
  1 ABRO UMBE      -------------------------------------------1-354-   101011
 31 CAMI CHEI      ---------------------------------------------432-   101011
 34 CARP EDUL      -------------------------------------------22113-   101011
 28 CAKI MARI      ----------------------------------2-2---1-213-21-   1011
 46 DIST SPIC      --------------------------------4567-1----1--1111   11
 54 FRAN SALI      ----------------------------1----1--------1-----4   11

                   0000000000000000000000000000000000000000001111111
                   0000000000000000000000000000111111111111110000001
                   000000000001111111111111111100000000111111011111
                   000000111110000011111111111100011111001111 00111
                   0111110001100011000001111111   00111
                    00111          001110000001
```

TABLE V-5. Ventura River Delta Plot/Species Data and TWINSPAN Classification, excluding Nonvegetated Categories, but including Rare Species. Groups derived from the TWINSPAN classification were used to identify associations (clusters) on the DECORANA scatterplots. Frequency values (1-7) for species in 49 plots are: 1 = 0-1% cover value; 2 = 2-4%; 3 = 5-9%; 4 = 10-24%; 5 = 25-49%; 6 = 50-74%; 7 = 75-100%. Hierarchy at right of table shows species classifications by TWINSPAN. Hierarchy below the table shows plots classification by TWINSPAN.

PLOTS

SPECIES

```
                  1 1  4333 211322442242442222  411 14333333 11144
                  4352640121089312124598786793893017208945675376564

 25 BROM DIAN     -------1---------45----------------2---------1---     0000
109 SONC ASPE     ------------------1------1-1--------------1------     0000
 21 BACC SALI     ----------5241523442-3344453-14----22------------     000100
 83 POLY MONS     ----------------2111-1-11111-------2--22---------     000100
117 XANT STRU     ------------------1---1----2-------1---1---------     000100
  2 ALNU RHOM     ------------------------2------------------------     000101
  6 APIU GRAV     ---------------------------1---------------------     000101
 12 ASTR TRIC     -----------------------1-------------------------     000101
 23 BRAC DIST     -------------------------1-----------------------     000101
 27 BROM RUBE     ----------------2----111-1-----------------------     000101
 29 CALY MACR     ---------------------1---------------------------     000101
 39 CONY CANA     ---------------------131-111---------------------     000101
 44 CYPE ERAG     ---------------------------1---------------------     000101
 49 ERIO PARV     ---------------------1---------------------------     000101
 50 ERIO CONF     --------------------------1----------------------     000101
 52 FILA CALI     -----------------------1-------------------------     000101
 53 FOEN VULG     ----------------221-1333-111---------------------     000101
 56 GNAP LUTE     ----------------------11--1----------------------     000101
 57 GNAP MICR     ---------------------1-1-------------------------     000101
 64 LACT SERR     ---------------1-----11--1-----------------------     000101
 65 LEMN MINO     ---------------------------1---------------------     000101
 67 LEPI SQUA     ------------------1-2212-------------------------     000101
 69 LOTU SCOP     ---------------------221-------------------------     000101
 70 LUDW URUG     ---------------------------5---------------------     000101
 71 MALA SAXA     --------------------------1----------------------     000101
 75 MELI ALBU     ------------------2--5634122-----------1---------     000101
 77 ORYZ MILI     --------------11--1-123112-----------------------     000101
 82 PERS PUNC     ---------------------------2---------------------     000101
 93 SALI LASI     ------------------------2--5---------------------     000101
 97 SALV LEUC     -----------------------2-------------------------     000101
114 URTI DIOI     ---------------------------1---------------------     000101
  4 AMBR PSIL     ----------------22----11-1-1-----------1---------     000101
  5 ANAG ARVE     ---------1--------114----------------------------     000101
  8 ARTE CALI     ----------1-----1-446-11--1----------------------     000101
  9 ARTE DOUG     -----------2------2---1--11----------------------     000101
 18 AVEN  SP.     --------------------1----------------------------     000101
 24 BRAS GENI     ----------2-4----2554233-122---------------------     000101
 26 BROM HORD     ----------------31----1--------------------------     000101
 33 CARD PYCN     ------------------232--1-------------------------     000101
 35 CENT MELI     ------------------413111-11----------------------     000101
 59 HETE GRAN     ------------------2---1--------------------------     000101
116 VULP MEGA     ------------------32---1-------------------------     000101
 10 ARUN DONA     ----------154723---1-----2----------2---1--------     000101
 45 DATU WRIG     ------------1------------------------------------     000101
 48 EPIL CILI     ---------------1-----------1---------------------     000101
 72 MALO LAUR     -----------4---------11--------------------------     000101
 76 NICO GLAU     ------------3------1--1--------------------------     000101
 86 RHUS OVAT     --------------2----------------------------------     000101
 87 RICI COMM     1-----------4------3-----------------------------     000101
 92 SALI LAEV     --------------36---------4-----------------------     000101
 95 SALI SESS     --------------2----------------------------------     000101
104 SENE MIKA     -----------77------------------------------------     000101
105 SOLA NODI     -------------1-------------1---------------------     000101
115 VERB LASI     ---------------1------1--------------------------     000101
 94 SALI LASO     ---4--5472-56775--42-2127554-----2---------------     000101
 47 ELYM COND     --3--------4-------------------------------------     000110
 88 RUBU URSI     ---------1-2-3-----------------------------------     000110
 55 GNAP CALI     1-------------------------1----------------------     000110
 74 MARR VULG     1--------1--------11-----1-----------------------     000110
103 SCRO CALI     --------1-1--2----1------------------------------     000110
```

TABLE V-5. (Continued)

PLOTS

SPECIES

```
  37 CLEM LIGU  --------5-13-------------------------------------  000110
  38 CONI MACU  2-11---3343-3--1---------------------------------  000110
  42 CUSC CEAN  ------41-----1-----------------------------------  000110
  62 JUGL CALI  -------5-----------------------------------------  000110
  63 JUNC TEXT  7------------------------------------------------  000110
  73 MARA FABA  -------3-----------------------------------------  000110
  84 POPU ALBA  ------65------3----------------------------------  000110
 106 SOLA XANT  ---------1---------------------------------------  000110
 112 TOXI DIVE  2---2-775552-7--1--------------------------------  000110
  19 BACC DOUG  ---2-----1-------------1---1---------------------  000110
  32 CARD DRAB  -45----------------------------------------------  000110
  51 EUPH LATH  1--1-1---1---------------------------------------  000110
  14 ATRI LENT  176677---542----24354-1------15---12--131--------  000111
  20 BACC PILU  ---33----54-2---55-----11-1---5------------------  000111
  43 CYNO DACT  -----------------11--1-133------------251--------  0010
  79 PICR ECHI  ---------------------------2-----------2---------  0010
  80 PLAN LANC  ---------------------111-----------1---1---------  0010
 108 EUTH OCCI  ----5------------1----------313--4-1-------------  001100
  11 ASTE SUBU  ---------------------------1-------1-------------  001101
  40 CORT JUBA  -----------------------------2-------------------  001101
  61 JAUM CARN  ----------------------------44446756-2-----------  001101
  66 LEPI LASI  ------------------------------1------------------  001101
  68 LOLI MULT  -----------------------------------2-------------  001101
 101 SCIR PUNG  ----------------------------------1--------------  001101
  91 RUPP CIRR  -------------------------------41----------------  001101
 100 SCIR MARI  ----------------------------3--74111-------------  001101
   7 ARTE BIEN  ---------------------------164---1-----21--------  001110
  99 SCIR CALI  ----------------------------453--2--77-----------  001110
  22 BASS HYSS  ----------------------------------1-----1--------  001111
  89 RUME CRIS  -----------------------------------1---1---------  001111
  16 ATRI PATU  ---------------------------1-------2257465-------  001111
  36 CHEN MACR  ------------------------------------114-43-------  001111
  41 COTU CORO  --------------------------------------2521-------  001111
  81 PLAN MAJO  ---------------------------------------1---------  0C1111
 102 SCIR  SP.  ------------------------------------1------------  001111
 110 SPER MARI  --------------------------------------6523-------  001111
 113 TYPH DOMI  ---------------------------3-1---1--4--2---------  001111
  58 HELI CURV  -1--3-----------------------222--11-------2------  01
  98 SALI VIRG  -----------------1----------7--46522------1-----7  01
 111 TETR TETR  5-1---------------------------------------2------  01
  60 ISOC VENE  ----------------33---------------------------121-  100
  78 PHAC RAMO  -------------------------1---------------------1-  100
  13 ATRI CALI  ------------------------------------------------1  10100
  15 ATRI LEUC  -------------------------------------------1-----  101010
  17 ATRI SEMI  ------------------------------------------1-1----  101010
  96 SALS AUST  ------------------------------------------1------  101010
   3 AMBR CHAM  ----------------------------------1-------244434-  101011
   1 ABRO UMBE  -------------------------------------------1-354-  101011
  30 CALY SOLD  --------------------------------------------11---  101011
  31 CAMI CHEI  ---------------------------------------------432-  101011
  34 CARP EDUL  -------------------------------------------22113-  101011
  28 CAKI MARI  ----------------------------------2-2---1-213-21-  1011
  46 DIST SPIC  --------------------------------4567-1----1--1111  11
  54 FRAN SALI  ----------------------------1----1--------1-----4  11

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                0000000000000000000000000000111111111111110000001
                000000000001111111111111111100000000111111011111
                000000111110000011111111111100011111001111 00111
                0111110001100011000001111111   00111
                 00111          00111000001
```

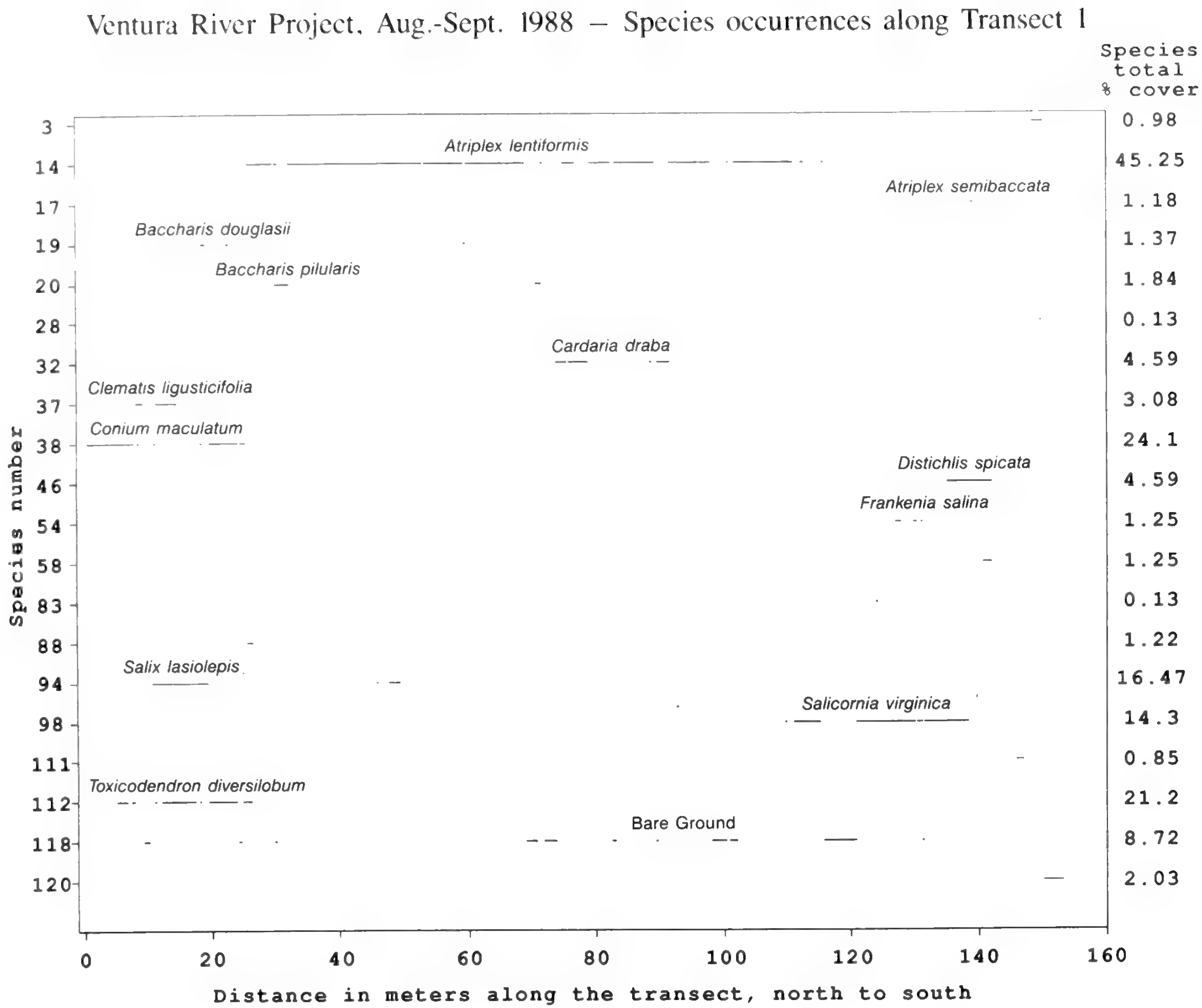

FIG. V-1. SPECIES OCCURRENCES AND TOTAL COVER ALONG TRANSECT 1. See Table V-1 for species names corresponding to numbers.

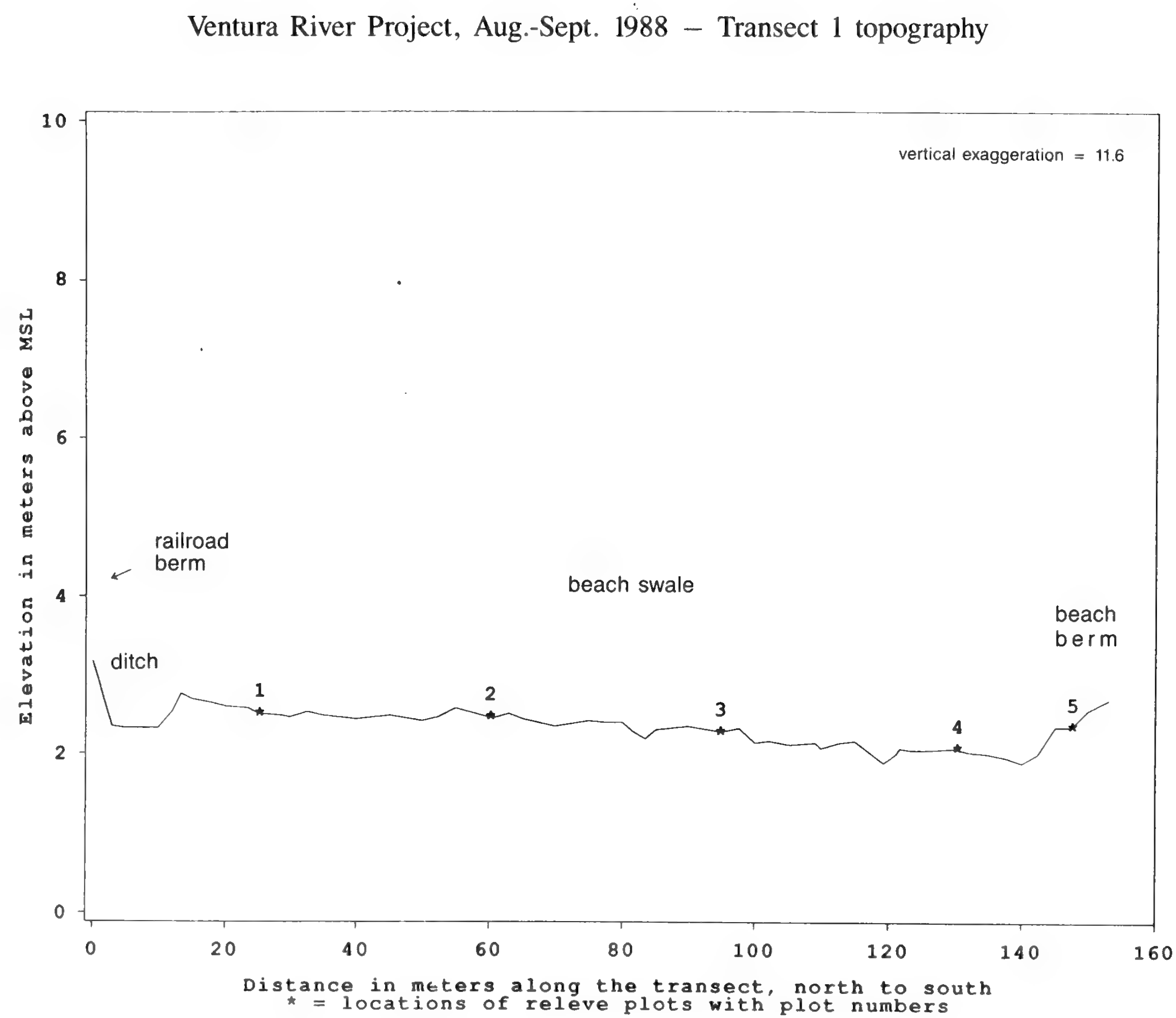

FIG. V-2. TOPOGRAPHIC RELIEF ALONG TRANSECT 1 [railroad embankment (N) to beach berm (S)].

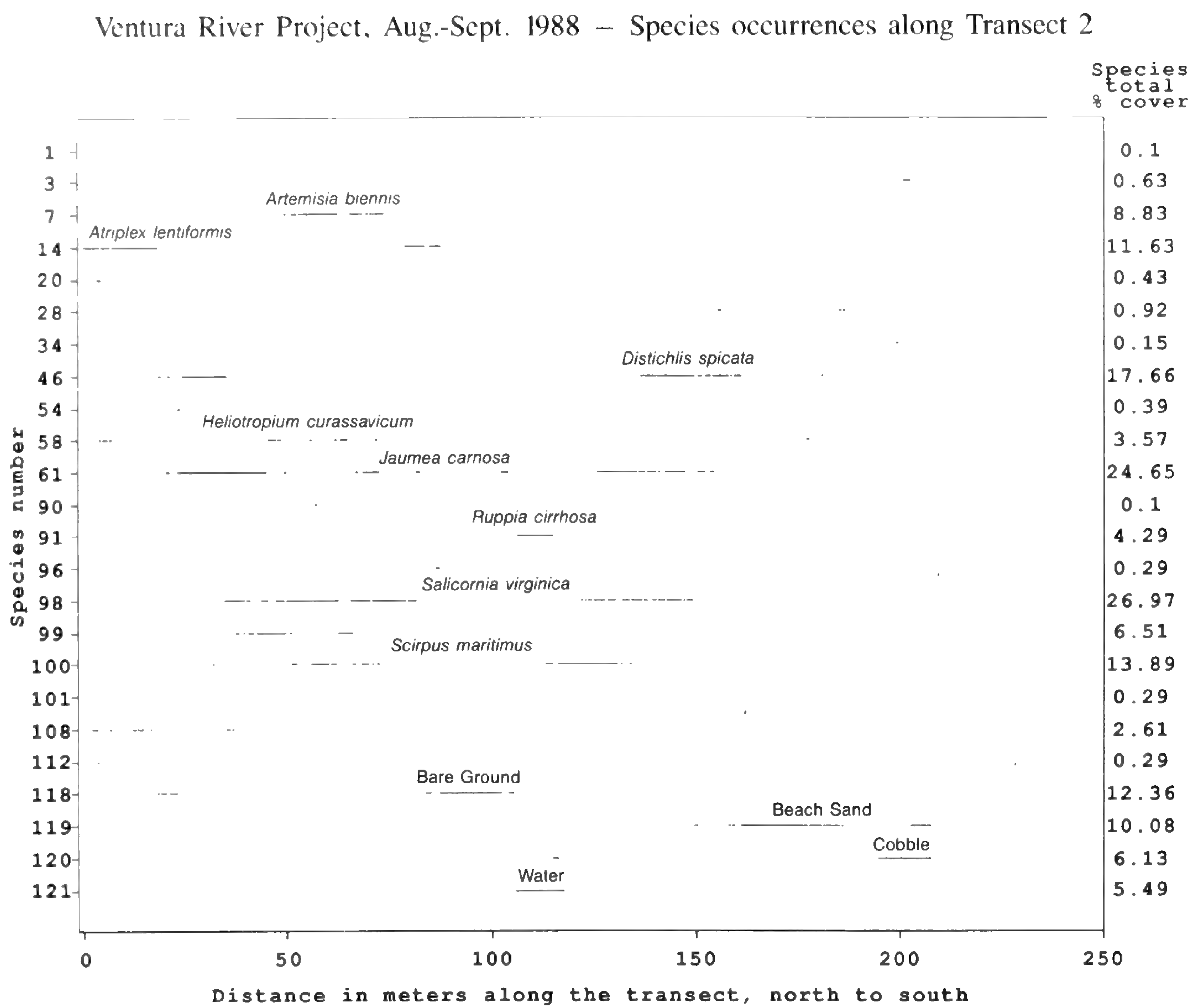

FIG. V-3. SPECIES OCCURRENCES AND TOTAL COVER ALONG TRANSECT 2. See Table V-1 for species names corresponding to numbers.

Ventura River Project, Aug.-Sept. 1988 – Transect 2 topography

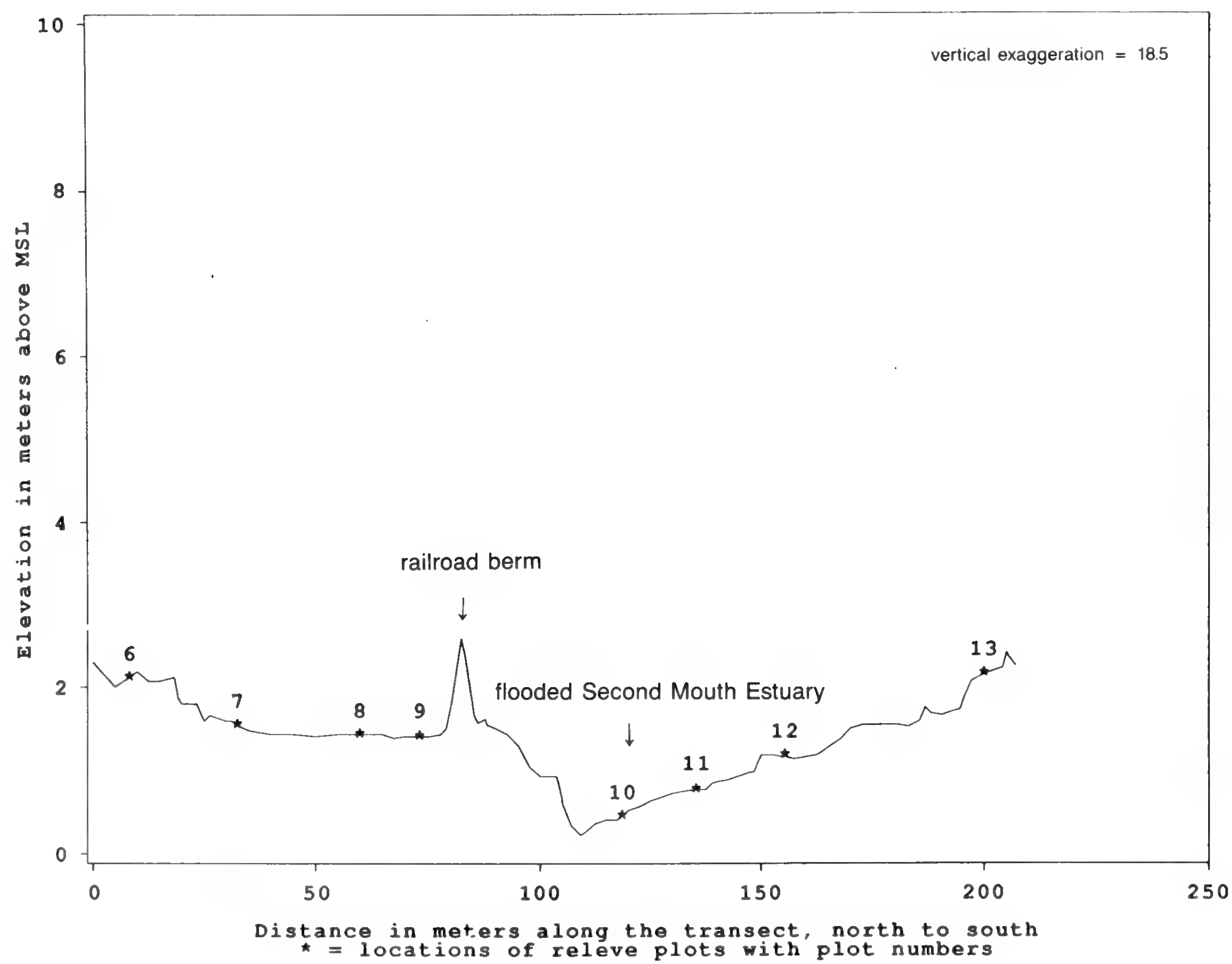

FIG. V-4. TOPOGRAPHIC RELIEF ALONG TRANSECT 2 [riparian scrub (N) to Second Mouth Estuary (center) and beach berm (S)].

Ventura River Project, Aug.-Sept. 1988 – Species occurrences along Transect 3

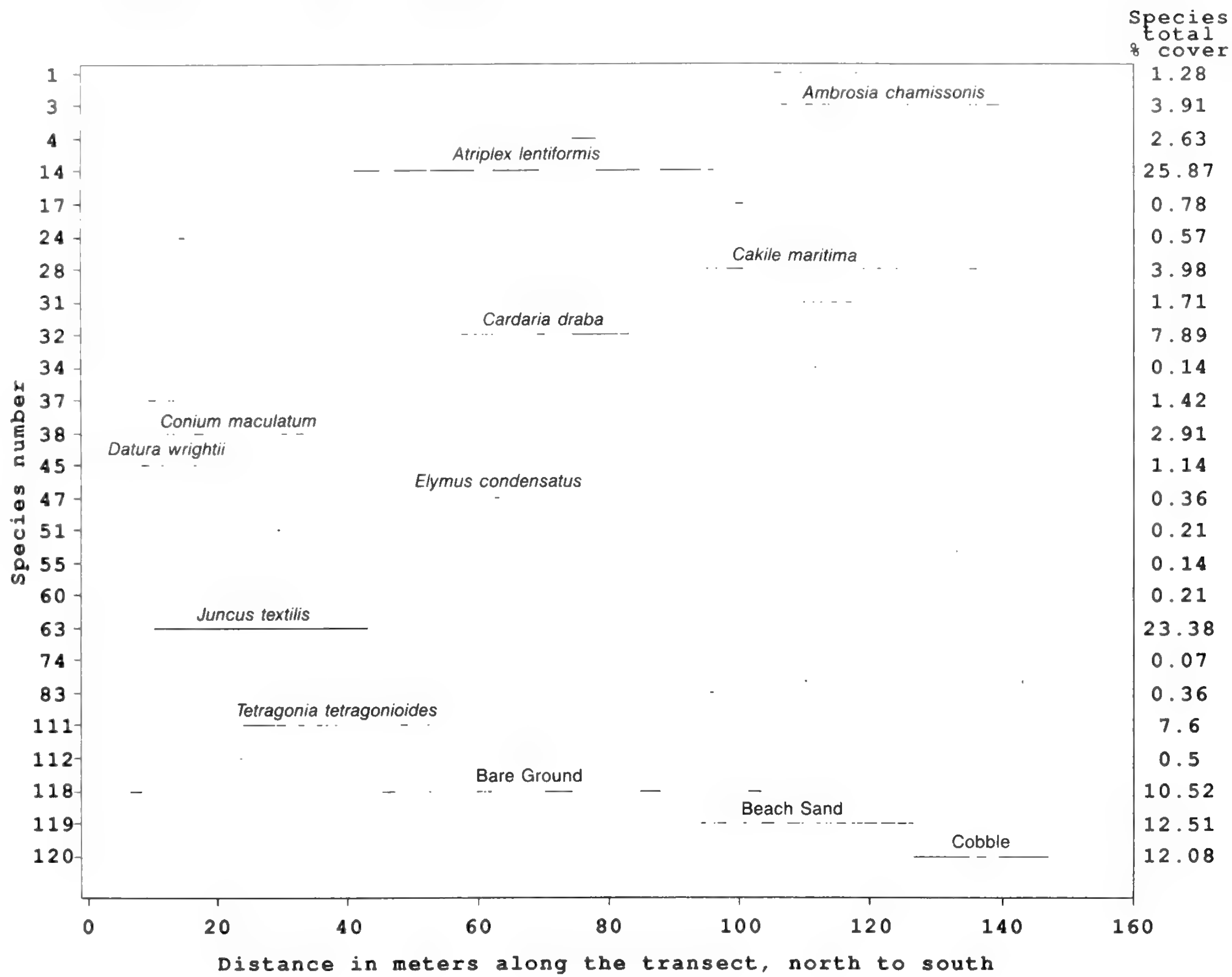

FIG. V-5. SPECIES OCCURRENCES AND TOTAL COVER ALONG TRANSECT 3. See Table V-1 for species names corresponding to numbers.

Ventura River Project, Aug.-Sept. 1988 — Transect 3 topography

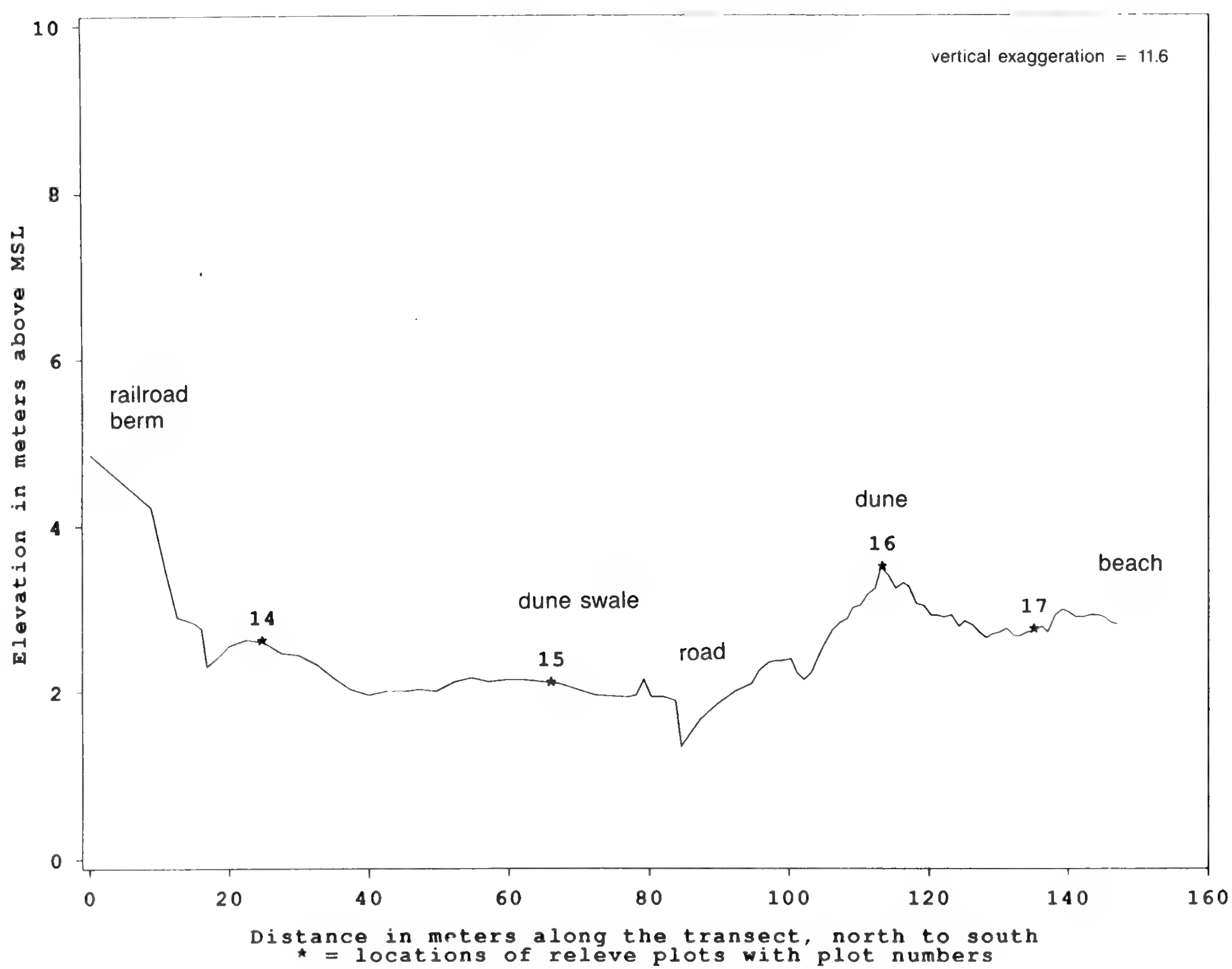

FIG. V-6. TOPOGRAPHIC RELIEF ALONG TRANSECT 3 [railroad (N) to dune swale (center) and dunes and beach (S)].

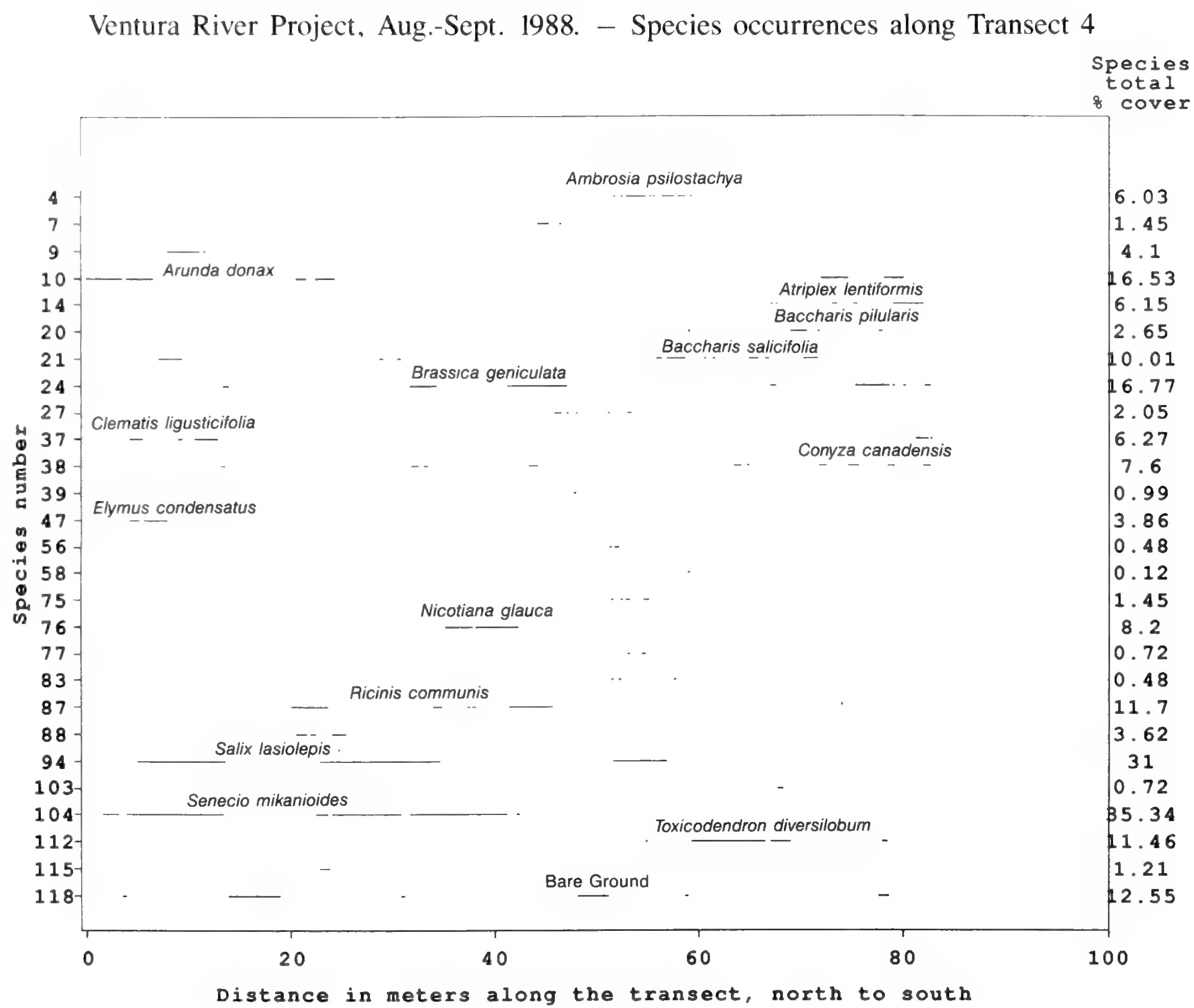

FIG. V-7. SPECIES OCCURRENCES AND TOTAL COVER ALONG TRANSECT 4. See Table V-1 for species names corresponding to numbers.

Ventura River Project, Aug.-Sept. 1988 – Transect 4 topography

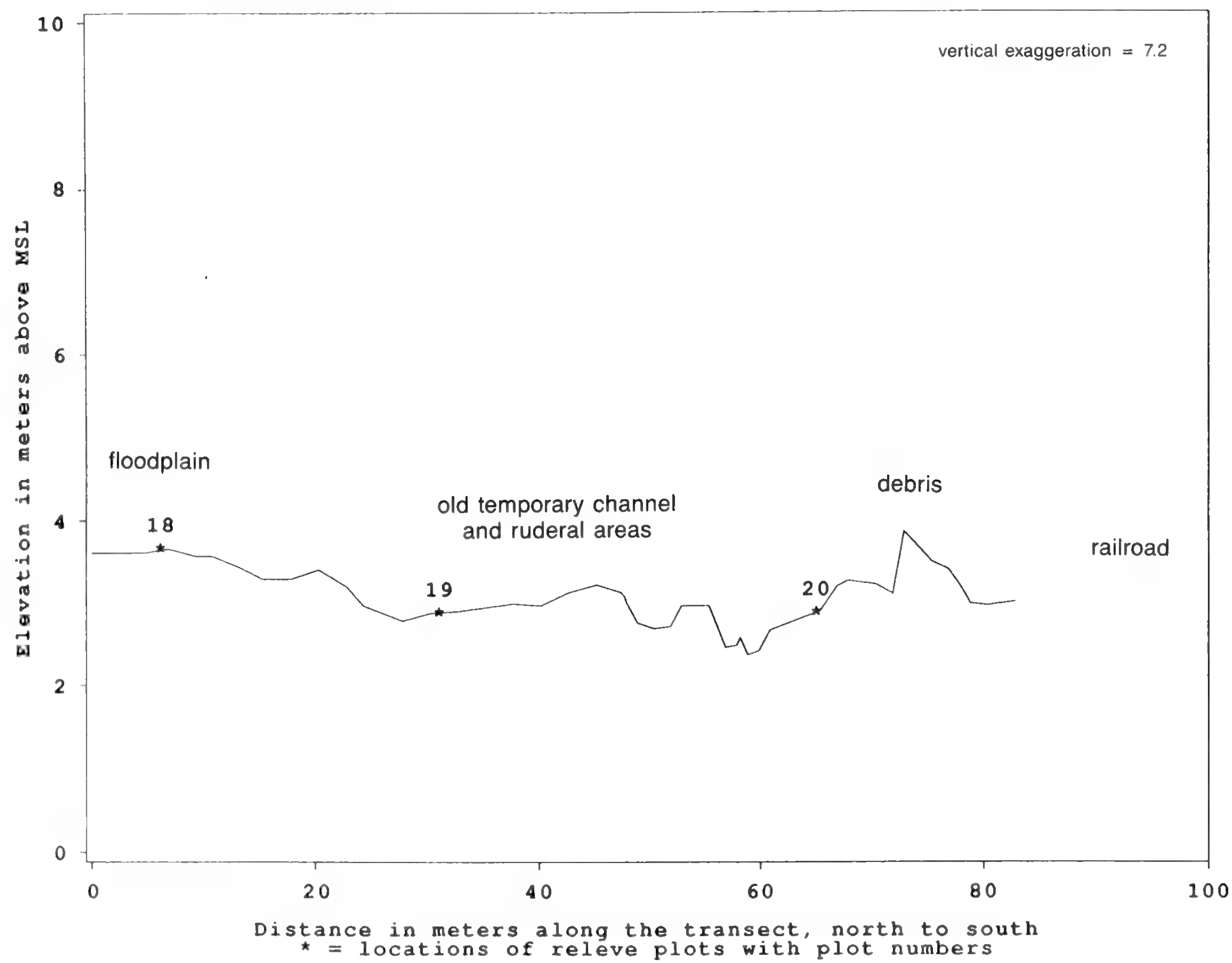

FIG. V-8. TOPOGRAPHIC RELIEF ALONG TRANSECT 4 [riparian scrub and margin of Ventura River Estuary (N) across ruderal areas to railroad embankment (S)].

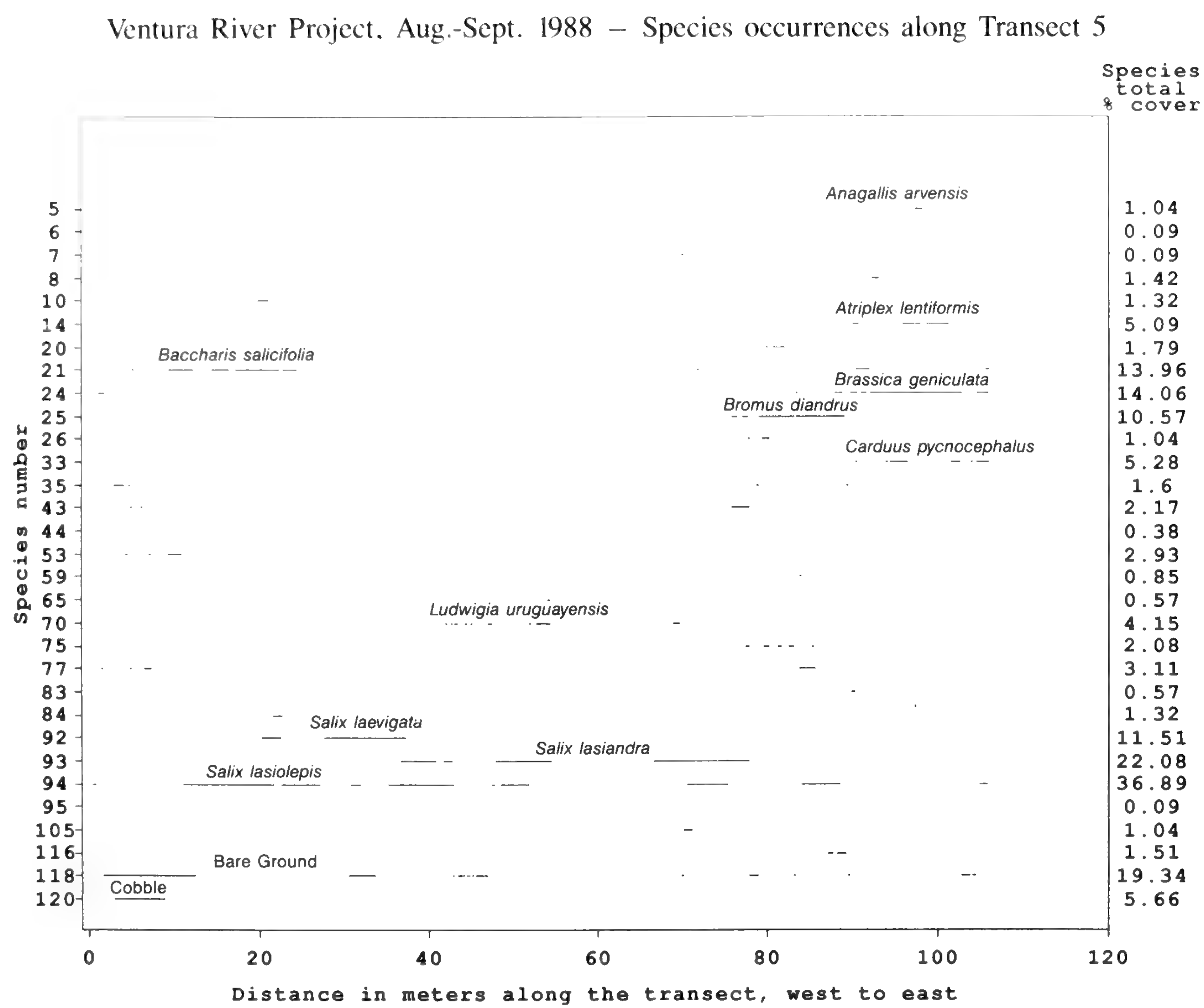

FIG. V-9. SPECIES OCCURRENCES AND TOTAL COVER ALONG TRANSECT 5. See Table V-1 for species names corresponding to numbers.

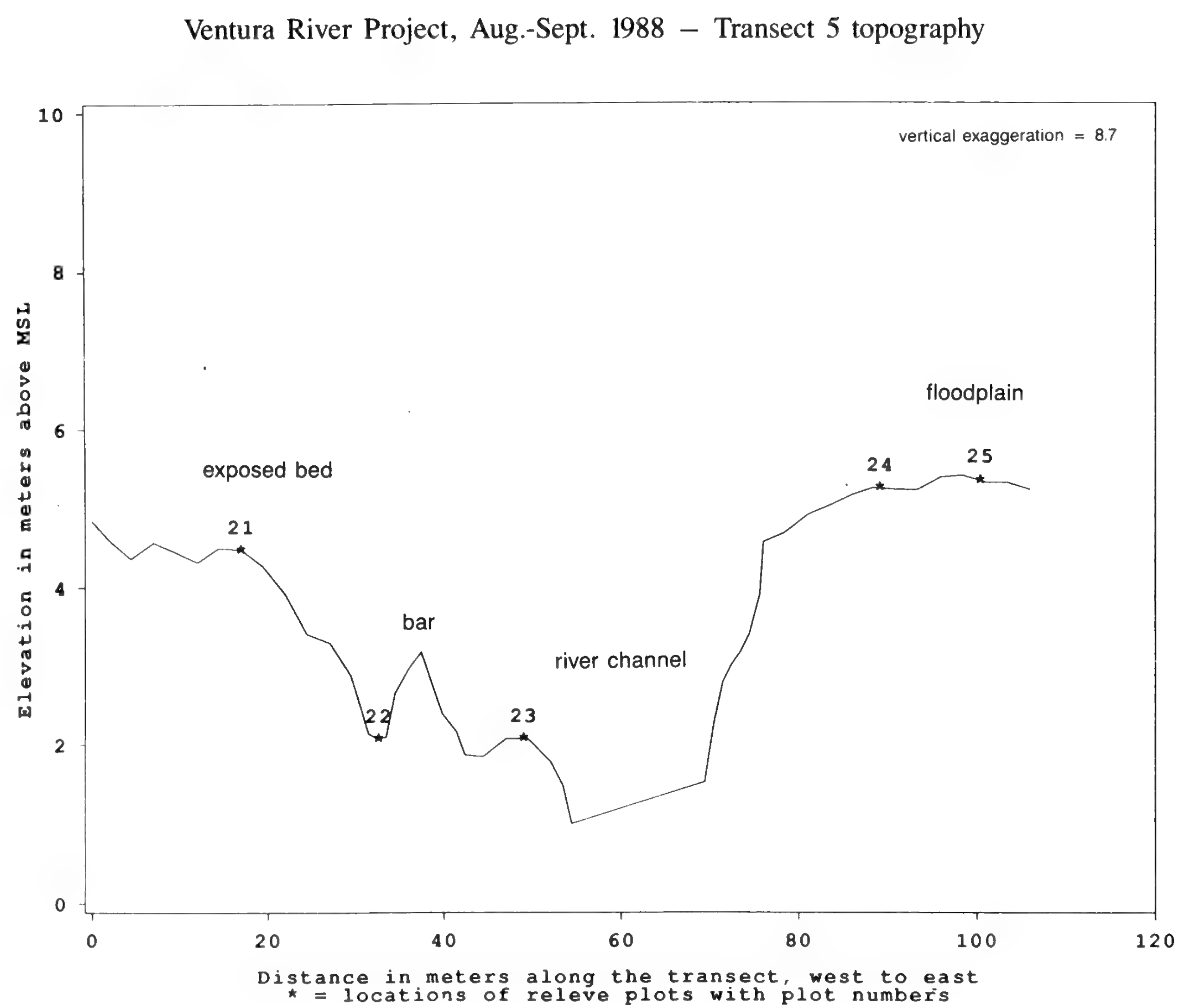

FIG. V-10. TOPOGRAPHIC RELIEF ALONG TRANSECT 5 [margin of floodplain (W) across river to floodplain (E)].

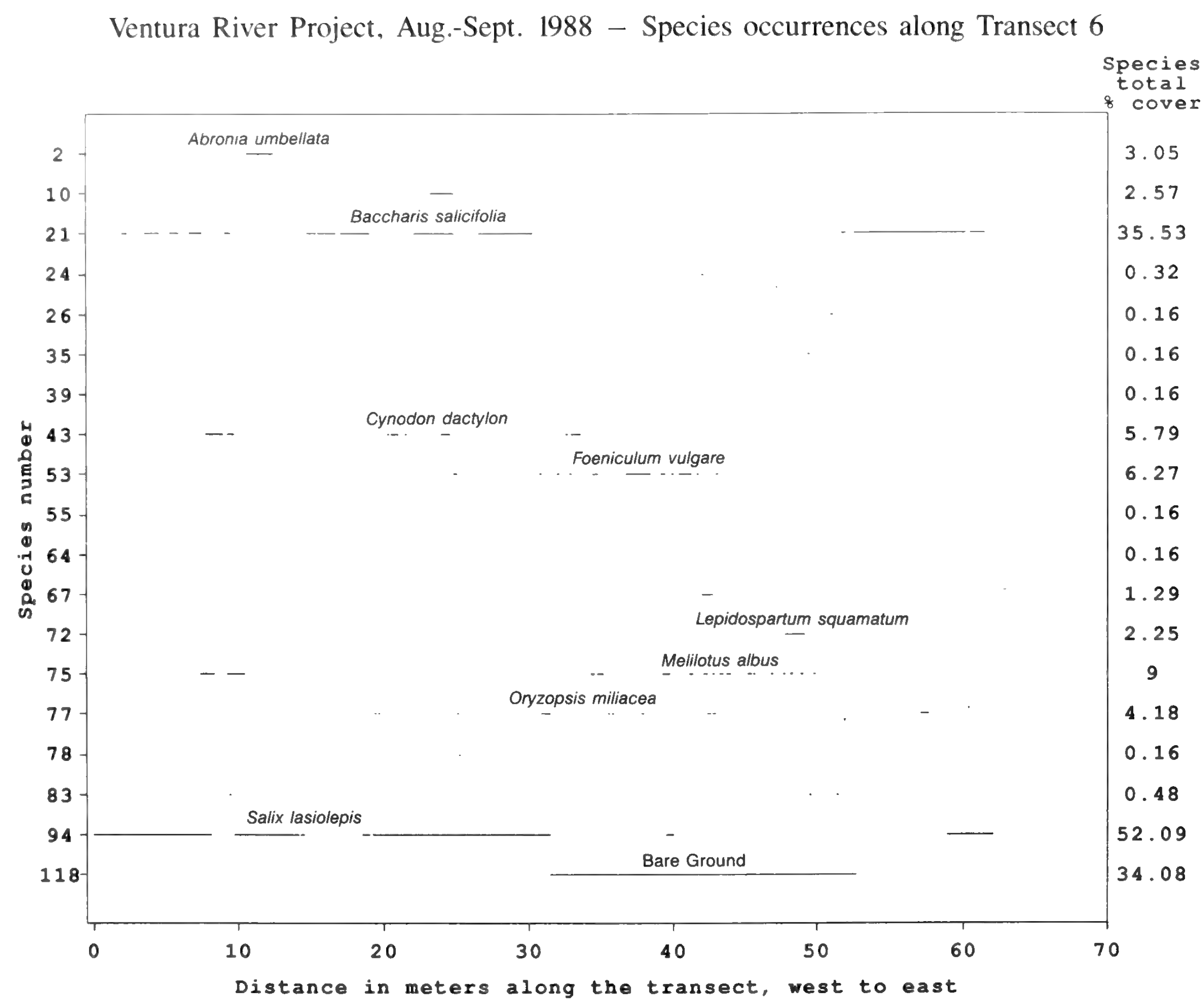

FIG. V-11. SPECIES OCCURRENCES AND TOTAL COVER ALONG TRANSECT 6. See Table V-1 for species names corresponding to numbers.

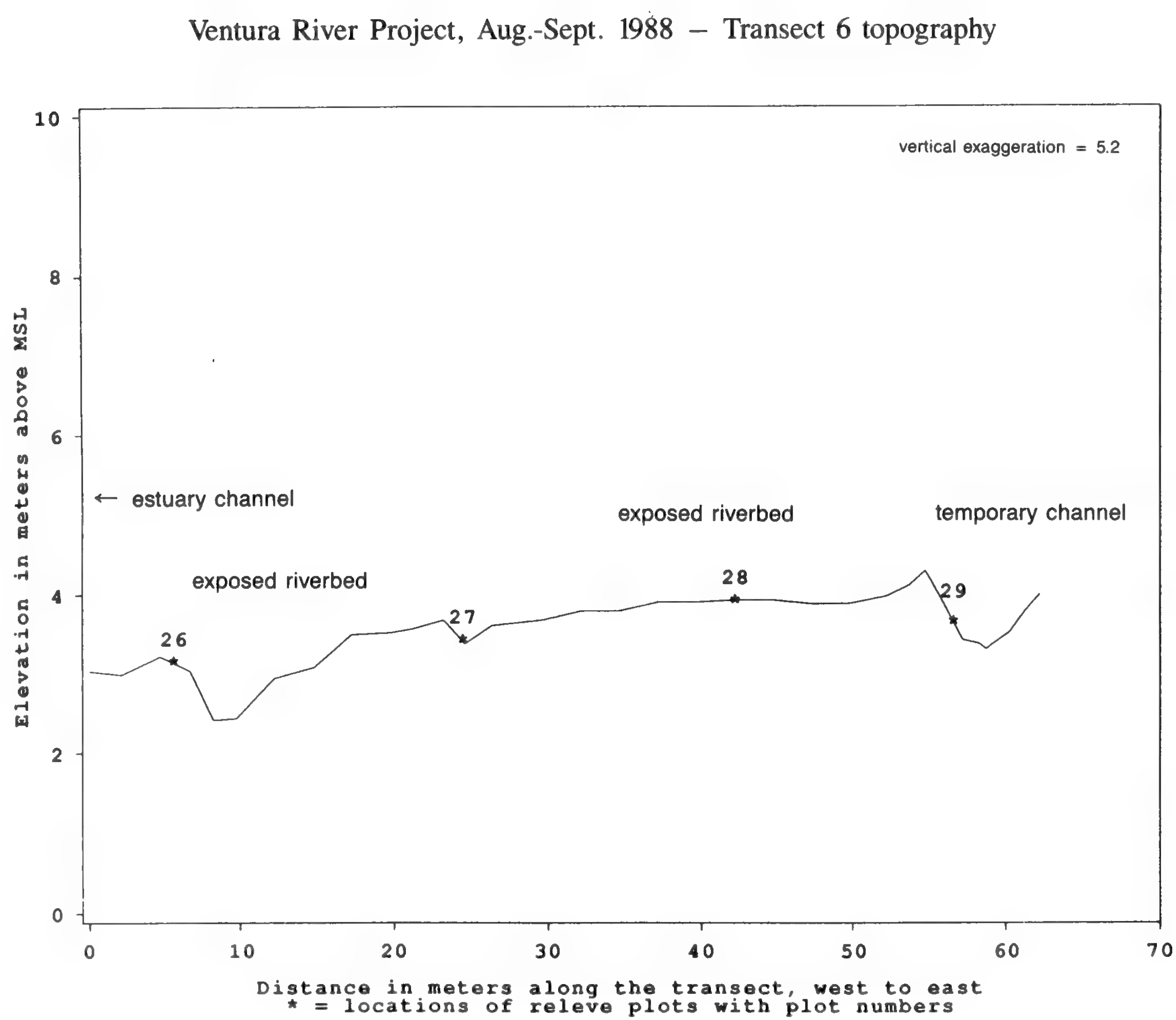

FIG. V-12. TOPOGRAPHIC RELIEF ALONG TRANSECT 6 [margin of Ventura River Estuary channel (W) across exposed riverbed to margin of floodplain (E)].

Ventura River Project, Aug.-Sept. 1988 – Species occurrences along Transect 7

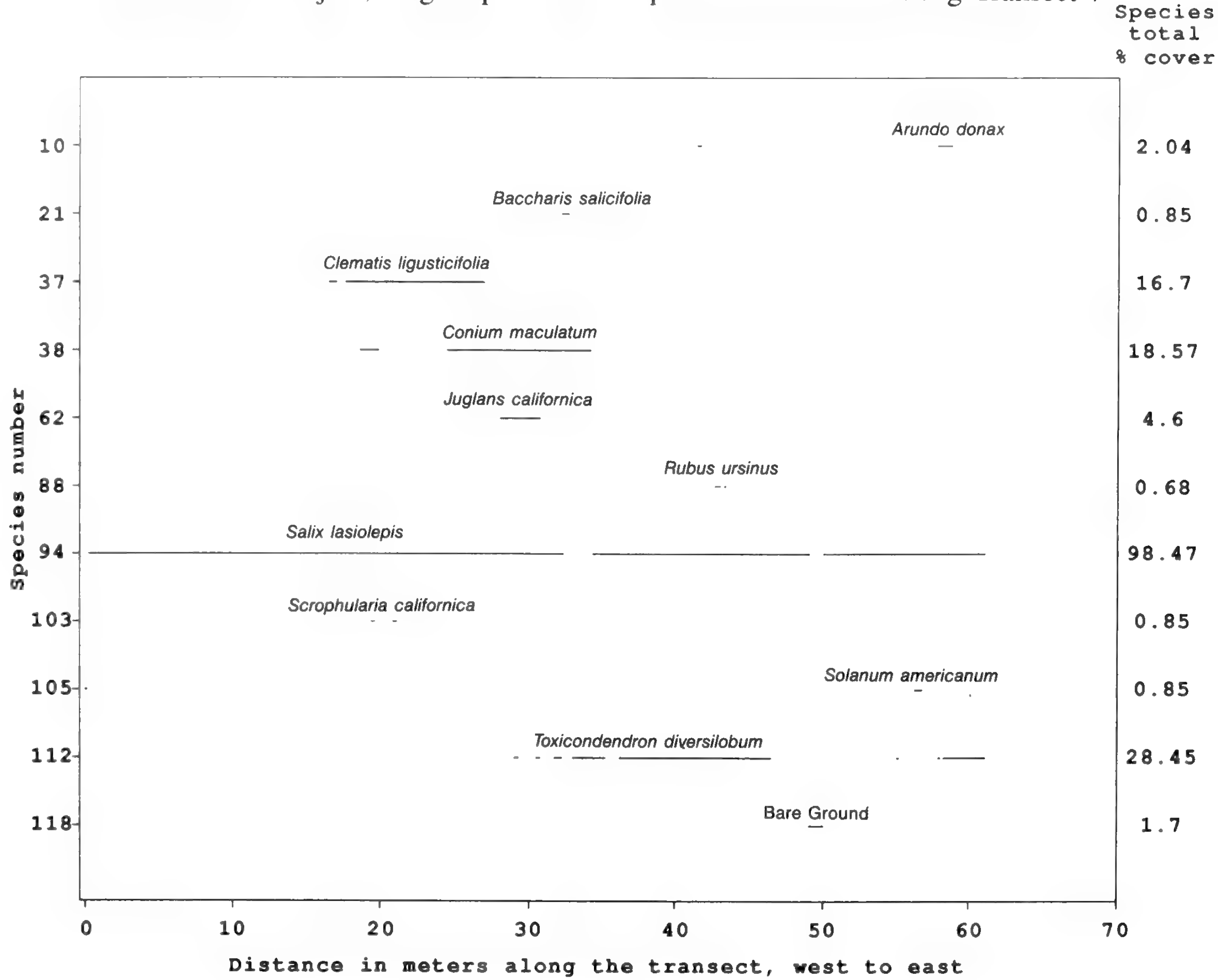

FIG. V-13. SPECIES OCCURRENCES AND TOTAL COVER ALONG TRANSECT 7. See Table V-1 for species names corresponding to numbers.

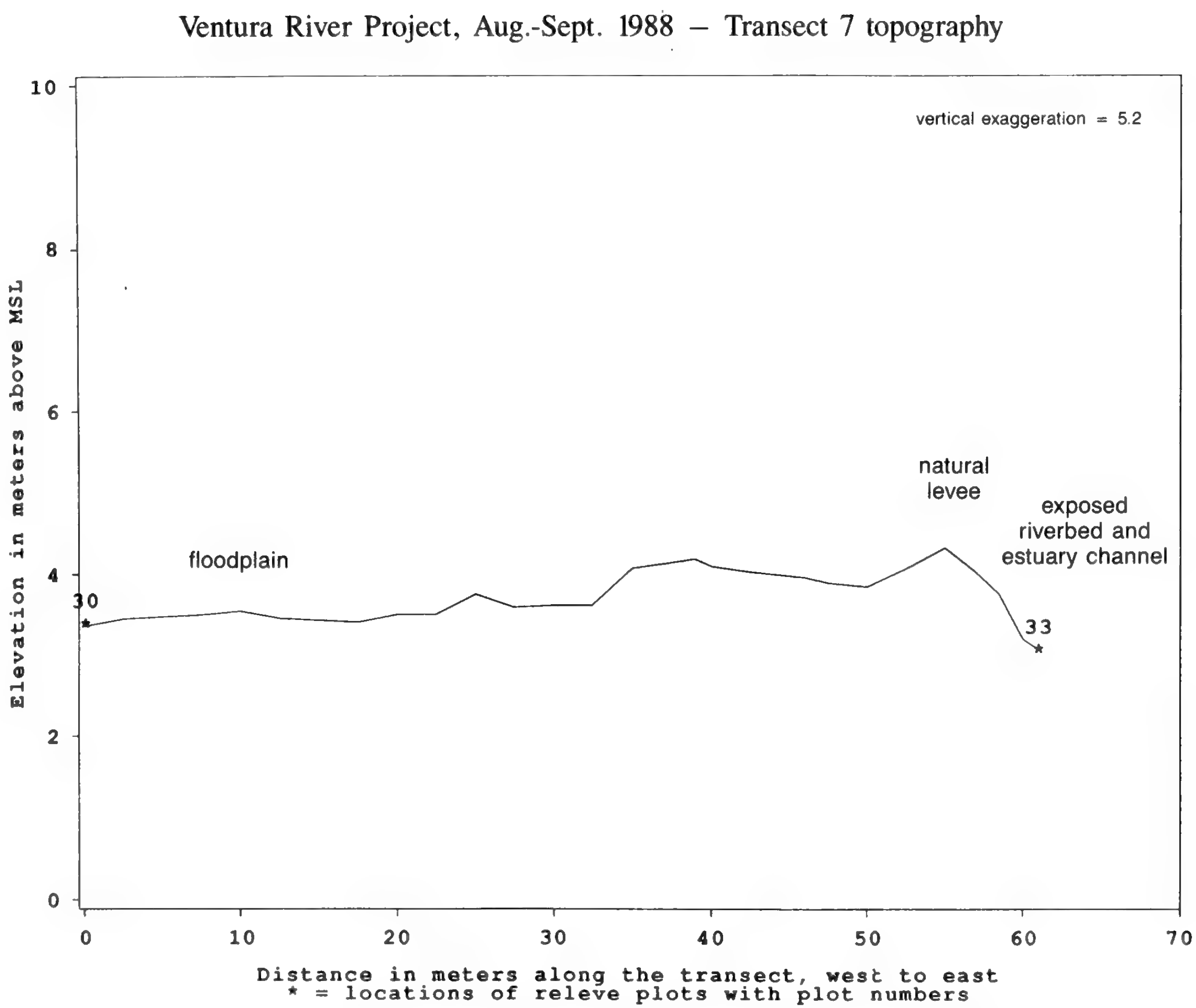

FIG. V-14. TOPOGRAPHIC RELIEF ALONG TRANSECT 7 [margin of trail in riparian woodland (W) across floodplain to exposed riverbed and margin of Ventura River Estuary channel (E)].

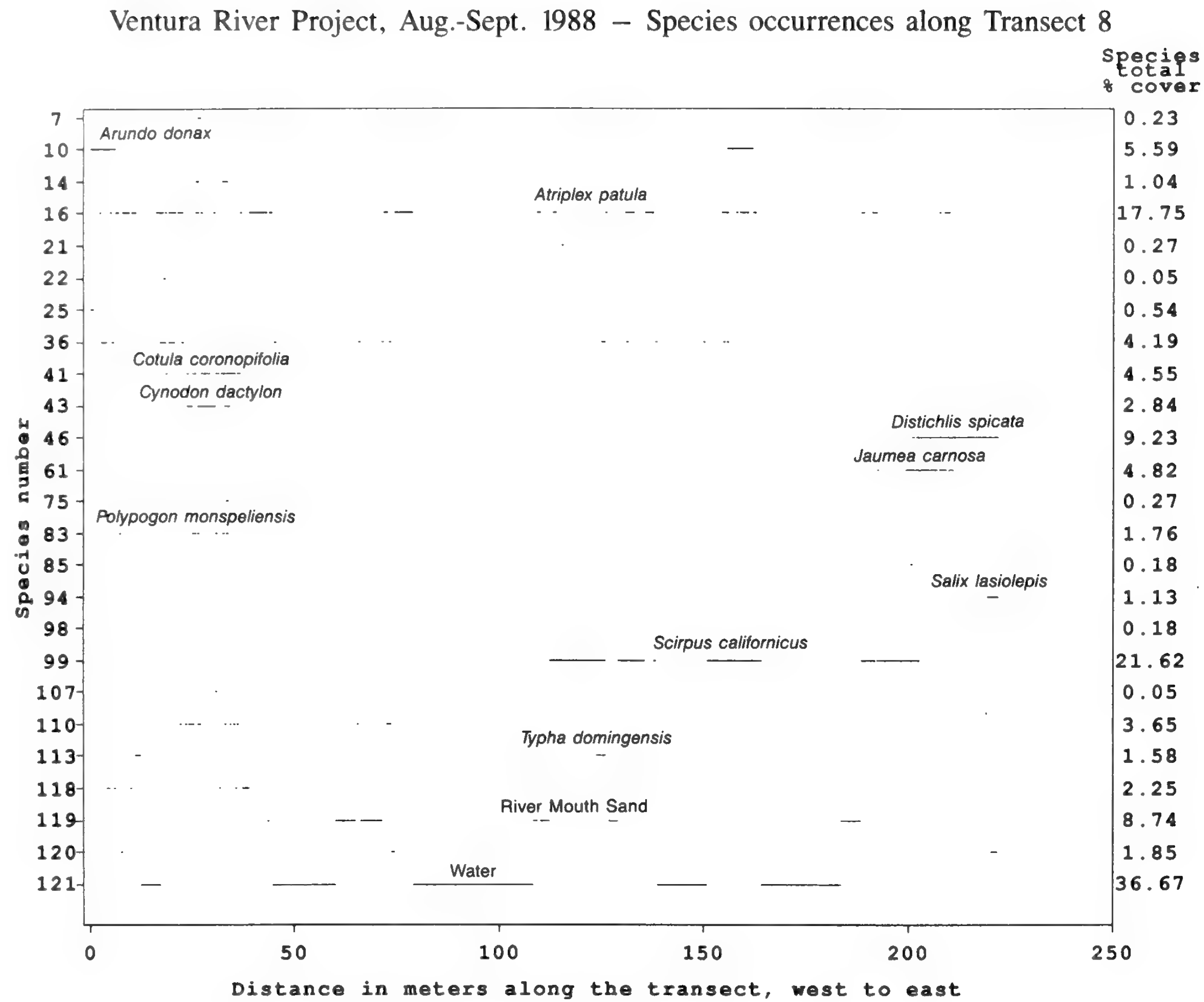

FIG. V-15. SPECIES OCCURRENCES AND TOTAL COVER ALONG TRANSECT 8. See Table V-1 for species names corresponding to numbers.

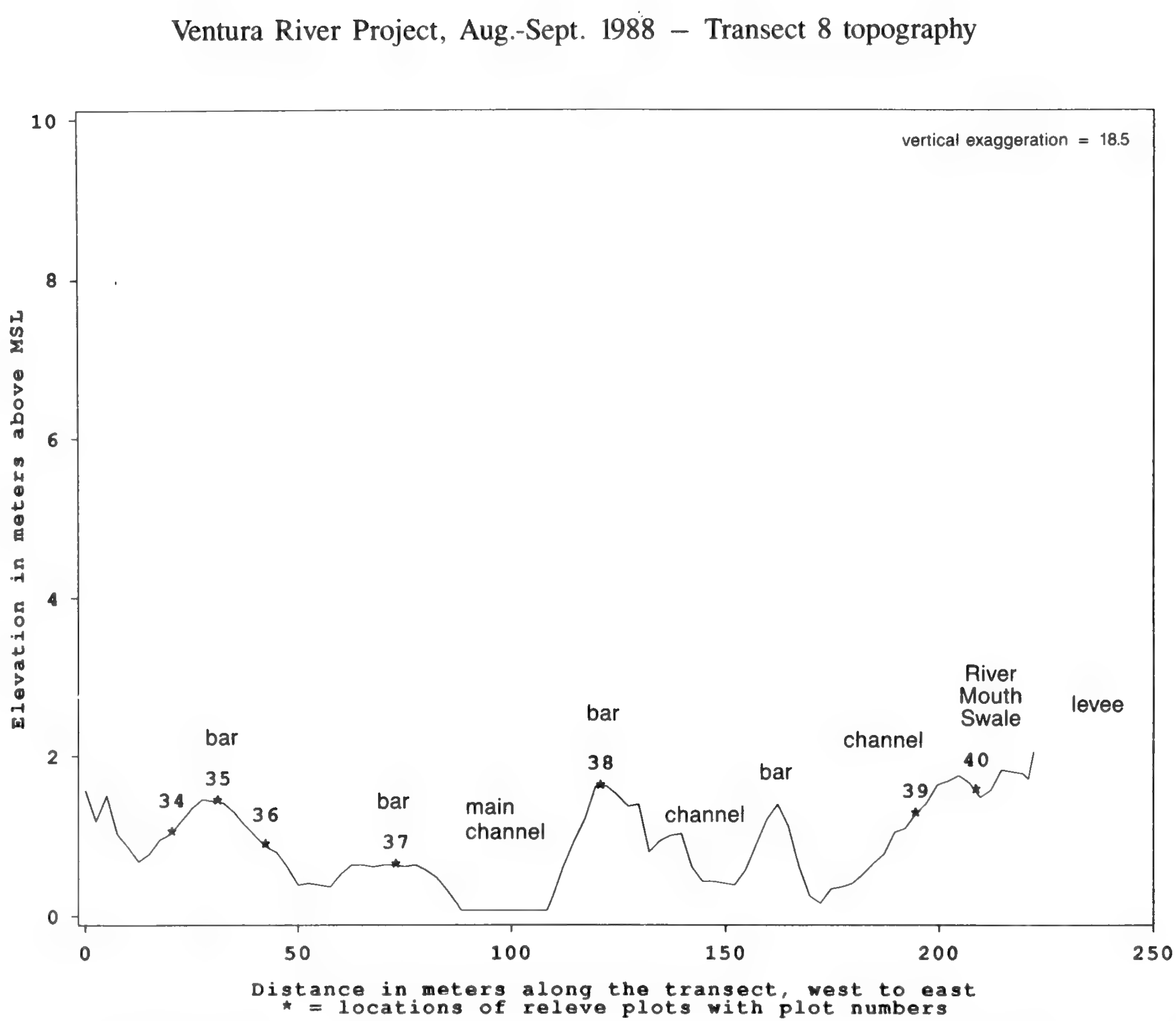

FIG. V-16. TOPOGRAPHIC RELIEF ALONG TRANSECT 8 [exposed margin of Ventura River Estuary (W) across estuary channels to swale on opposing margin of estuary (E)].

Ventura River Project, Aug.-Sept. 1988 – Species occurrences along Transect 9

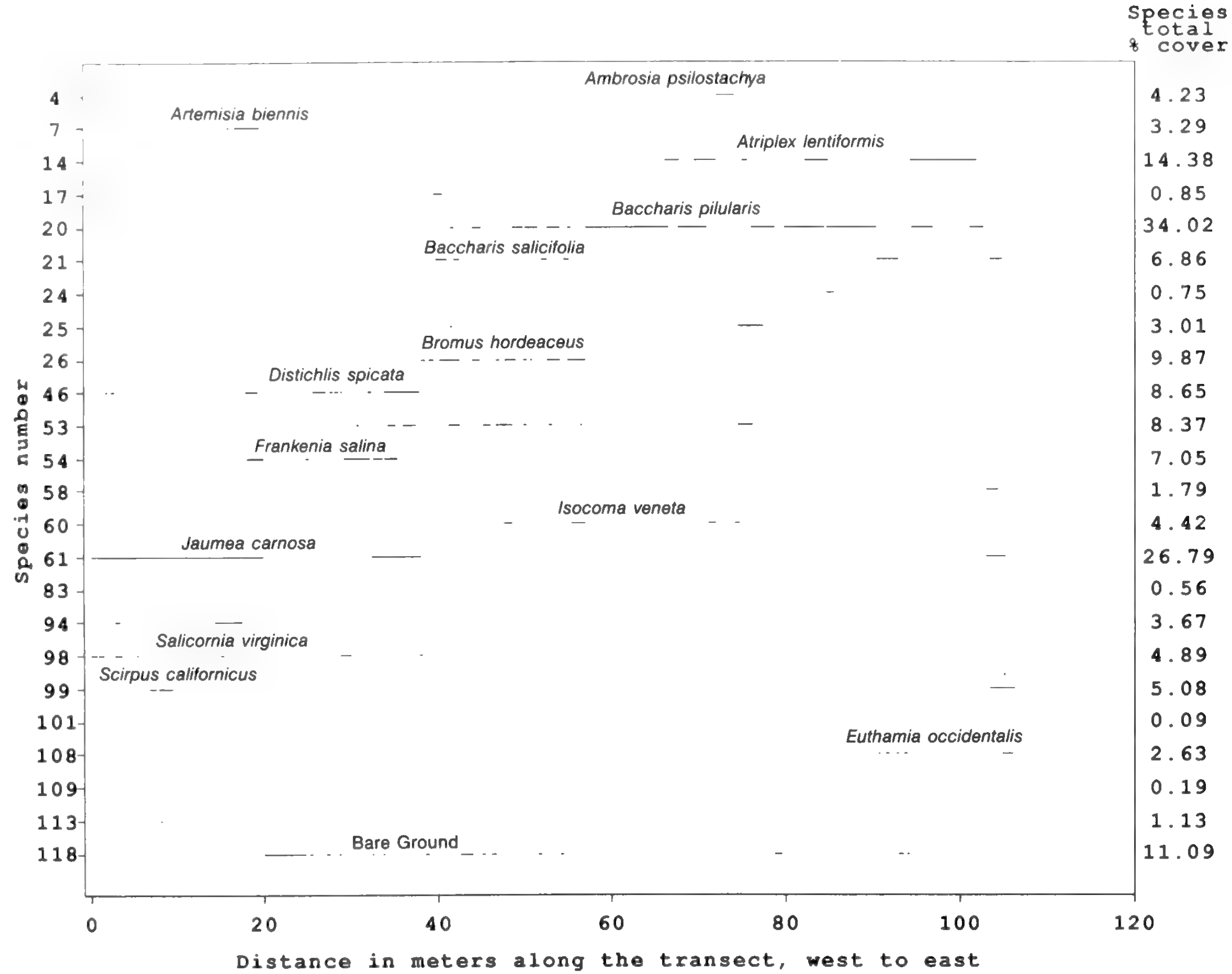

FIG. V-17. SPECIES OCCURRENCES AND TOTAL COVER ALONG TRANSECT 9. See Table V-1 for species names corresponding to numbers.

Ventura River Project, Aug.-Sept. 1988 — Transect 9 topography

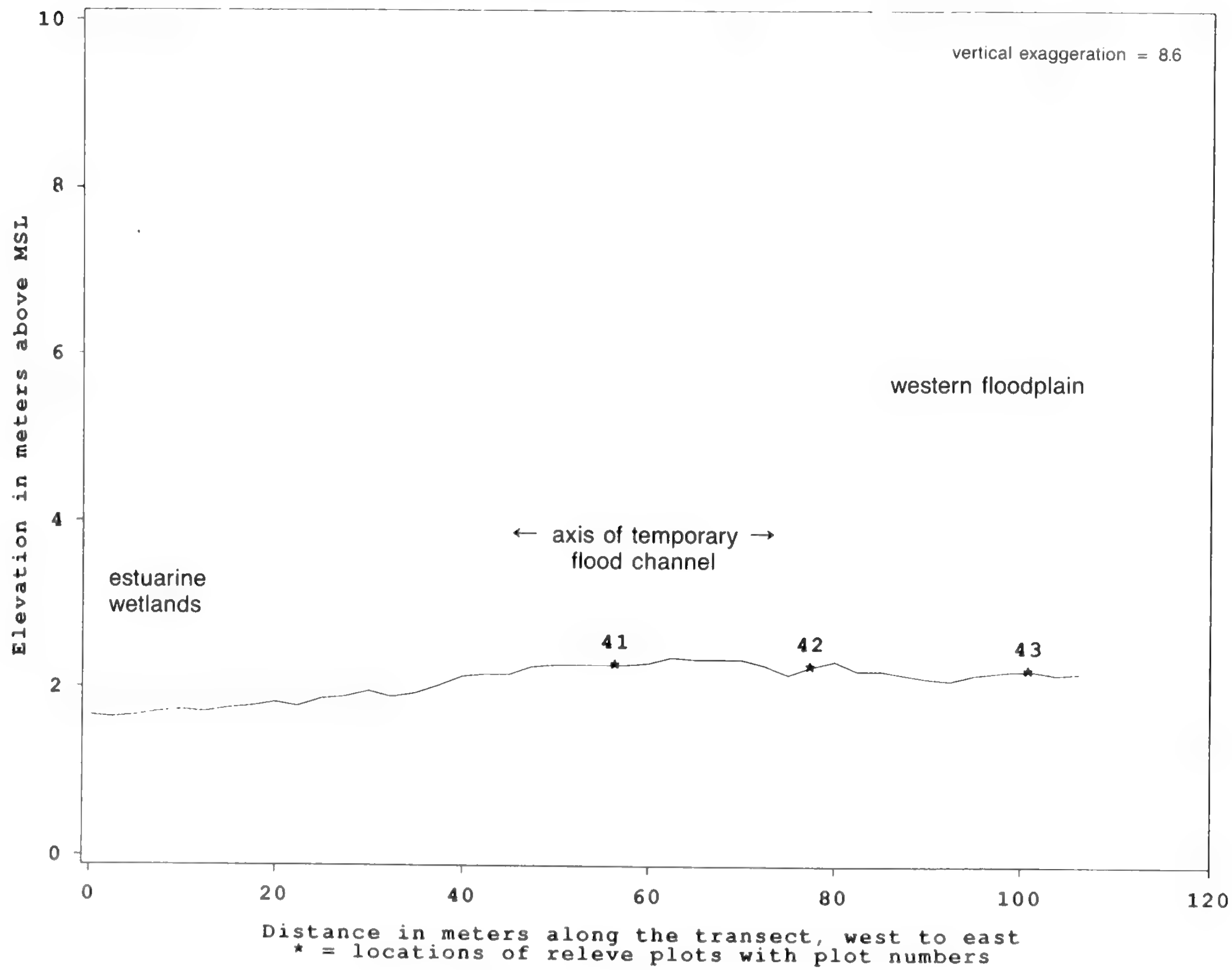

FIG. V-18. TOPOGRAPHIC RELIEF ALONG TRANSECT 9 [margin of estuarine wetlands of Second Mouth Estuary (W) up axis of temporary river channel and riparian scrub (E) on western floodplain].

APPENDIX VI

ANNOTATED CATALOGUE OF THE MARINE ALGAE FROM THE VENTURA RIVER DELTA:

INTERTIDAL WETLANDS AND NEAR SHORE SUBTIDAL DEEPWATER HABITATS

ANNOTATED CATALOGUE

OF THE MARINE ALGAE

The Annotated Catalogue includes all native or introduced species of algae found by the authors in the intertidal and near shore subtidal area off the Ventura River Delta, including Emma Wood State Beach, Seaside Wilderness Park, and the Ventura County Fairgrounds, or are supported by specimens housed at the herbaria at the University of California, Santa Barbara (UCSB), or the Los Angeles County Museum of Natural History (LAM).

The catalogue is arranged phylogenetically at the Division, Class and Order ranks, and alphabetically by family genus, and species. Taxonomy and nomenclature follow Abbott and Hollenberg (1976). Included for each taxon are scientific name, characteristic substrate, habitat(s) (high, mid, low intertidal, and/or subtidal), occurrence (abundant, common, occasional, uncommon, rare), collection sites (#1 through #10 on Appendix III: Map of the Marine Wetlands and Deepwater Habitats), collection number, and depository. All voucher references to Dawson are to specimens collected at the end of Palm Street, immediately east of our collection site #10, between December 1956, and February 1959.

The collection number is the voucher specimen number for taxa deposited in the UCSB Herbarium that have been collected in the study area, or the voucher housed in LAM. Each voucher citation includes the collector(s) name, collection number, and depository (herbarium) acronym.

A total of 107 taxa of marine algae have been collected from the study area: 20 Chlorophyta, 10 Phaeophyta, and 78 Rhodophyta. Fourteen collections were identified only to genus. With the exception of *Sargassum muticum*, all taxa are native to the study area. The marine angiosperms are recorded in the catalogue of vascular plants.

ANNOTATED CATALOGUE OF MARINE ALGAE

DIVISION CHLOROPHYTA

Class CHLOROPHYCEAE

Order CODIALES

Family BRYOPSIDACEAE

Bryopsis corticulans Setch. Attached to cobble, high to low intertidal; occasional; 4, 7; *Capelli, et al. VRD 1-88, 1-89* (UCSB); *Dawson 15766* (LAM).

Order CLADOPHORALES

Family CLADOPHORACEAE

Chaetomorpha linum (Müll.) Kütz. Attached to exposed and buried cobble; mid to low intertidal; abundant; 1, 4, 5, 9; *Capelli et al. VRD 1-87, 2-88, 3-88, 4-88* (UCSB); *Dawson* (=*C. aerea*) *20712* (LAM).

Cladophora columbiana Coll. Attached to cobble; mid to low intertidal; occasional; 1: *Capelli et al. VRD 5-88* (UCSB).

Cladophora microcladiodes Coll. Attached to cobble; low intertidal; common; *Dawson 15785, 20724* (LAM).

Cladophora sakaii Abb. Attached to cobble; mid to low intertidal; occasional; 8; *Capelli et al. VRD 6-88* (UCSB).

Cladophora sp. Attached to cobble; mid to low intertidal; abundant; 1, 5, 8; *Capelli et al. VRD 7-88, 8-88, 9-88, 10-88, 11-88, 12-88* (UCSB).

Family CODIACEAE

Codium setchellii Gardn. Attached to top of cobble; mid to low intertidal; occasional; 1; *Capelli et al. VRD 13-88, 14-88* (UCSB).

Order ULOTRICHALES

Family ULVACEAE

Enteromorpha clathrata (Roth) Grev. Attached to cobble; high to mid intertidal; common; 4, 8; *Capelli et al. VRD 16-88, 17-88, 18-88* (UCSB).

Enteromorpha compressa (L.) Grev. Attached to cobble, also occasionally epiphytic; occasional; *Dawson 17291, 17298* (LAM).

Enteromorpha intestinalis (L.) Link. Attached to cobble, also in sand at outlet to Ventura River; high intertidal; abundant; 8, *Capelli et al. VRD 2-87* (UCSB); *Dawson 15746, 15747, 20714* (LAM).

Enteromorpha linza (L.) J. Ag. Attached to cobble, occasionally epiphytic; high to mid intertidal; common; 1, 4, 6; *Capelli et al. VRD 3-87, 19-88, 20-88, 21-88* (UCSB).

Enteromorpha sp. Attached to cobble; high to mid intertidal; common; 1, 2; *Capelli et al. VRD 22-88, 23-88* (UCSB); *Dawson 20713, 20723* (LAM).

Ulva angusta S. & G. Attached to cobble; mid to low intertidal; occasional; 6: *Capelli et al. VRD 4-87* (UCSB); *Dawson 20710, 20721* (LAM).

Ulva californica Wille. Attached to cobble, occasionally epiphytic; occasional; 4; *Capelli et al. VRD 24-88* (UCSB).

Ulva costata (Howe) Hollenb. Attached to cobble; high to mid intertidal; common; 3, 5, 8; *Capelli et al. VRD 25-88, 26-88, 27-88, 28-88* (UCSB).

Ulva lactuca L. Attached to cobble, high intertidal to subtidal; uncommon; *Dawson 15748* (LAM).

Ulva lobata (Kütz) S. & G. Attached to cobble; high to mid intertidal; occasional; 8, 9; *Capelli et al. VRD 29-88, 30-88, 31-88* (UCSB).

Ulva taeniata (Setch.) S. & G. Attached to cobble; high to mid intertidal; common; 2, 3, 5; *Capelli et al. VRD 5-87, 2-89, 3-89, 4-89, 5-89* (UCSB); *Dawson 15750, 17297, 17304* (LAM).

Ulva sp. Attached to cobble; high to mid intertidal; occasional 2; *Capelli et al. VRD 32-88* (UCSB); *Dawson 17314* (LAM).

DIVISION PHAEOPHYTA

Class PHAEOPHYCEAE

Order ECTOCARPALES

Family ECTOCARPACEAE

Ectocarpus parvus (Saund.) Hollenb. Epiphytic; low intertidal to subtidal; common; *Dawson* (=E. *confervoides*) *17313* (LAM).

Ectocarpus sp. Epiphytic; low intertidal to subtidal; common; 7; *Capelli et al. VRD 15-88* (UCSB); *Dawson 15774, 20734* (LAM).

Order CHORDARIALES

Family RALFSIACEAE

Ralfsia pacifica Hollenb. Attached to cobble; high to mid intertidal; uncommon; 5; *Capelli et al. VRD 41-88* (UCSB).

Order DESMARESTIALES

Family DESMARESTIACEAE

Desmarestia ligulata (Lightf.) Lamour. Attached to cobble; mid to low intertidal; occasional; 5, 8; *Capelli et al. VRD 38-88, 39-88* (UCSB).

Order FUCALES

Family CYSTOSEIRACEAE

Cystoseira osmundecea (Turn.) C.Ag. Attached to cobble; low intertidal to subtidal; rare; 1; *Capelli et al. VRD 36-88, 37-88* (UCSB).

Family SARGASSACEAE

Sargassum muticum (Yendo) Fensh. Attached to substrate; mid to low intertidal; rare, 3; *Capelli et al. VRD 12-87* (UCSB).

Order LAMINARIALES

Family ALARIACEAE

Egregia australis (Daw.) Attached to buried and exposed cobble; low intertidal to subtidal; occasional; *Dawson 15769* (LAM).

Egregia menziesii (Turn.) Aresch. Attached to buried and exposed cobble; low intertidal to subtidal; common; 5, 6, 9; *Capelli et al. VRD 8-87, 9-87, 10-87* (UCSB).

Family LESSONIACEAE

Macrocystis pyrifera (L.) C. Ag. Attached to cobble; subtidal; uncommon; 2, 4; *Capelli et al. VRD 11-87, 40-88* (UCSB).

Order SCYSTOSIPHONALES

Family SCYTOSIPHONACEAE

Colpomenia peregrina (Sauv.) Ham. Epiphytic on Macrocystis pyrifera and unattached; high intertidal to subtidal; uncommon; 1, 4, 9; *Capelli et al. VRD 33-88, 34-88, 35-88* (UCSB).

Division RHODOPHYTA

Class FLORIDEOPHYCEAE

Order CERAMIALES

Family CERAMIACEAE

Centroceras clavulatum (C. Ag.) Mont. Attached to cobble; high to low intertidal; common; *Dawson 15753* (LAM).

Ceramium californicum J. Ag. Attached to cobble; also epiphytic; mid to low intertidal; common; *Dawson 15776* (LAM).

Ceramium pacificum (Coll.) Kyl. Epiphytic, also attached to cobble; mid intertidal to subtidal; common; *Dawson 17312* (LAM).

Ceramium sp. Epiphytic, also attached to cobble; mid intertidal to subtidal; common; 4, 5; *Capelli et al. VRD 55-88, 56-88* (UCSB).

Microcladia californica Farl. Epiphytic on Egregia menziesii; low intertidal to subtidal; common; *Dawson 17316* (LAM).

Pleonosporium squarrulosum (Harv.) Abb. Epiphytic on a variety of algae; low intertidal to subtidal; common; *Dawson (=P. dasyoides) 15778* (LAM).

Family CORALLINACEAE

Corallina vancouveriensis Yendo. Attached to cobble; mid to low intertidal; occasional; 1, 9; *Capelli et al. VRD 60-88, 61-88* (UCSB); *Dawson 15758, 15764, 20716* (LAM).

Family DELESSERIACEAE

Acrosorium uncinatum (Turn.) Kyl. Epiphytic on a variety of intertidal and subtidal species; high intertidal to subtidal; uncommon; 5, 9; *Capelli et al. VRD 42-88, 43-88, 44-88* (UCSB); *Dawson 20731* (LAM).

Botryoglossum farlowianum (J. Ag.) DeToni. Attached to cobble; low intertidal to subtidal; common; *Dawson 15766, 17322* (LAM).

Cryptopleura violacea (J. Ag.) Kyl. Attached to cobble, and also epiphytic; low intertidal to subtidal; common; 1, 2, 3 (subtidal), 7, 9; *Capelli et al.* and

Capelli and *Douros VRD 14-87, 15-87, 16-87, 62-88, 63-88, 64-88, 65-88, 66-88, 67-88, 23-89, 24-89, 25-89* (UCSB); *Dawson 15783, 17311, 17324.*

Erythroglossum californicum (J. Ag.) J. Ag. Attached to cobble; low intertidal; occasional; *Dawson 15784* (LAM).

Nienburgia andersoniana (J. Ag.) Kyl. Attached to cobbles exposed and buried in sand; lower intertidal to subtidal; common; 1, 3 (subtidal), 9; *Capelli et al.* and *Capelli* and *Douros VRD 157-88, 158-88, 68-89, 69-89* (UCSB).

Myriogramme spectabilis (Eat.) Kyl. Attached to cobble, also epiphytic; low intertidal to subtidal; common; *Dawson 20727* (LAM).

Phycodrys setchellii Skottsb. Attached to cobble; low intertidal to subtidal; uncommon; 2; *Capelli et al. VRD 159-89* (UCSB).

Polyneura latissima (Harv.) Kyl. Attached to cobble; mid intertidal to subtidal; common; *Dawson 15777* (LAM).

Family RHODOMELACEAE

Chondria decipiens Kyl. Attached to cobble; mid to low intertidal; common; *Dawson* (=C. *cornuta*) *15756, 15767, 15770, 17295, 17309* (LAM).

Chondria nidifica Harv. Attached to cobble; mid intertidal to subtidal; common; 2 (subtidal), 3 (subtidal); *Capelli* and *Douros VRD 14-89, 15-89, 16-89, 17-89, 18-89, 19-89, 20-89, 21-89, 22-89* (UCSB); *Dawson 15761, 17320, 20724* (LAM).

Chondria sp. Attached to cobble; high to low intertidal; occasional; 1, 9; *Capelli et al. VRD 13-87; 56-89, 57-89, 58-89, 59-89* (UCSB).

Janczewskia lappacea Setch. Parasitic on *Chondria nidifica*; low intertidal and subtidal; common; 2 (subtidal), 3 (subtidal); *Capelli* and *Douros VRD 19-89, 20-89, 21-89, 22-89* (UCSB).

Laurencia spectabilis var. diegoensis (Daws.) Daws. Attached to cobble; lower intertidal and subtidal; common; 1, 3 (subtidal), 6, 9; *Capelli et al.* and *Capelli* and *Douros VRD 146-88, 147-88, 148-88, 149-88, 150-88, 151-88, 152-88, 65-89* (UCSB).

Polysiphonia paniculata Mont. Attached to cobble; lower intertidal; common; *Dawson 15749, 15755, 15765, 17300, 20717,* (LAM).

Polysiphonia spp. Attached to cobble, also epiphytic; high to low intertidal; common; 1, 2, 4, 5, 7; *Capelli et al. VRD 161-88, 162-88, 163-88, 164-88, 165-88, 74-89, 75-89, 76-89, 77-89* (UCSB).

Pterosiphonia baileyi (Harv.) Falk. Attached to cobble; low intertidal to subtidal; common; 2 (subtidal); 3 (subtidal), 5, 9; *Capelli et al.* and *Capelli* and *Douros VRD 174-88, 175-88, 79-89, 80-89, 81-89, 82-89, 83-89, 84-89* (UCSB); *Dawson 17315* (LAM).

Pterosiphonia dendroidea (Mont.) Falk. Attached to cobble, occasionally epiphytic; low intertidal to subtidal; abundant; 2 (subtidal), 3 (subtidal), 4, 8, 9; *Capelli et al*. and *Capelli* and *Douros VRD 42-87, 43-87, 176-88, 177-88, 178-88, 179-88, 85-89, 86-89, 87-89, 88-89, 89-89, 90-89, 91-89, 92-89, 93-89*; *Dawson 15773, 17299, 17308, 17318, 20732* (LAM).

Order CRYPTONEMIALES

Family CRYPTONEMIACEAE

Cryptonemia obovata J. Ag. Attached to cobble; low intertidal to subtidal; common; *Dawson 15779* (LAM).

Grateloupia doryphora (Mont.) Howe. Attached to cobble exposed and buried in sand; high to low intertidal and subtidal; abundant; 1, 2 (subtidal), 3 (subtidal), 8, 9; *Capelli et al.* and *Capelli* and *Douros VRD 27-87, 28-87, 29-87, 30-87, 31-87, 123-88, 124-88, 125-88, 126-88, 127-88, 128-88, 129-88, 130-88, 131-88, 132-88, 133-88, 134-88, 135-88, 51-89, 52-89, 53-89, 54-89, 55-89, 56-89, 57-89, 58-89, 59-89, 60-89, 61-89* (UCSB).

Grateloupia filicina (Lamour.) C. Ag. Attached to cobble; mid to low intertidal; occasional; 5, 7; *Capelli et al. VRD 136-88, 137-88* (UCSB).

Grateloupia setchellii Kyl. Attached to cobble exposed and buried in sand; mid to low intertidal; occasional; 1, 4, 8; *Capelli et al. VRD 32-87, 33-87, 138-88, 139-88, 140-88* (UCSB).

Grateloupia sp. Attached to cobble exposed and buried in sand; mid to low intertidal; rare; 1, 4, 5, 8; *Capelli et al. VRD 34-87, 141-88, 142-88, 143-88, 62-89, 63-89* (UCSB).

Prionitis angusta (Harv.) Okam. Attached to cobble; low intertidal to subtidal; occasional; 7; *Capelli et al. VRD 172-88* (UCSB).

Prionitis australis (J. Ag.) J. Ag. Attached to cobble; low intertidal to subtidal; occasional; 9; *Capelli et al. VRD 173-88* (UCSB).

Family CORALLINACEAE

Bossiella orbigniana (Dec.) Silva. Attached to cobble; mid to low intertidal; occasional; 1, 5; *Capelli et al. VRD 50-88, 51-88* (UCSB).

Bossiella sp. Attached to cobble; mid to low intertidal; occasional; 7; *Capelli et al. VRD 52-88* (UCSB).

Melobesia mediocris (Fosl.) Setch. & Mason. Epiphytic on Phyllospadix spp.; low intertidal to subtidal; common; 4; *Capelli et al. VRD 66-89, 67-89* (UCSB).

Family DUMONTIACEAE

Farlowia mollis (Harv. & Bail.) Farl. & Setch. Attached to cobble; mid intertidal to subtidal; uncommon; 9; *Capelli et al. VRD 17-87* (UCSB).

Cryptosiphonia woodii (J. Ag.) J. Ag. Attached to cobble; mid intertidal; common; 1; *Capelli et al. VRD 68-88, 69-88* (UCSB).

Family KALLYMENIACEA

Callophyllis flabellulata Harv. Attached to cobble; subtidal; occasional; 2 (subtidal); *Capelli* and *Douros VRD 6-89* (UCSB).

Callophyllis obtusifolia J. Ag. Attached to cobble; subtidal; common; 2, (subtidal), 3 (subtidal); *Capelli* and *Douros VRD 7-89, 8-89, 9-89, 10-89, 11-89, 12-89* (UCSB); *Dawson 15782* (LAM).

Callophyllis violacea J. Ag. Attached to cobble; low intertidal to subtidal; occasional; 2 (subtidal); 9; *Capelli et al. Capelli* and *Douros VRD 53-88, 13-89* (UCSB); *Dawson 17323* (LAM).

Callophyllis sp. Attached to cobble; mid to low intertidal; uncommon; 9; *Capelli et al. VRD 54-88* (UCSB).

Family WEEKSIACEAE

Leptocladia binghamiae J. Ag. Attached to cobble; lower intertidal to subtidal; common; *Dawson 17316* (LAM).

Leptocladia sp. Attached to cobble; lower intertidal to subtidal; rare; 2; *Capelli et al. VRD 153-88* (UCSB).

Order NEMALIALES

Family GELIDIACEAE

Gelidium coulteri Harv. Attached to cobble and limpets; lower intertidal; common; *Dawson 17293* (LAM).

Gelidium pusillum (Stackh.) Le Jol. Attached to cobble; low intertidal; common; 6, 7; *Capelli et al. VRD 18-87, 72-88, 73-88, 74-88* (UCSB).

Pterocladia sp. Attached to cobble; mid to low intertidal, also subtidal; 7; *Capelli et al. VRD 174-88, 175-88, 176-88* (UCSB).

Family NEMALIACEAE

Cumagloia andersonii (Farl.) S. & G. Attached to cobble; mid to low intertidal; occasional; 3, 4; *Capelli et al. VRD 70-88, 26-89* (UCSB).

Nemalion helminthoides (Vell.) Batt. Attached to cobble and occasional metallic debris; high intertidal; uncommon; 7; *Capelli et al. VRD 154-88, 155-88* (UCSB).

Order RHODYMENIALES

Family CHAMPIACEAE

Gastroclonium coulteri (Harv.) Kyl. Attached to cobble; mid to low intertidal; common; 9; *Capelli et al. VRD 71-88* (UCSB).

Family RHODYMENIACEAE

Rhodymenia californica Kyl. Attached to cobble; low intertidal; common; 3 (subtidal), 8; *Capelli et al. VRD 44-87* (UCSB).

Rhodymenia pacifica Kyl. Attached to cobble; subtidal; occasional; 9; *Capelli* and *Douros VRD 183-88, 94-89* (UCSB).

Order GIGARTINALES

Family GIGARTINACEAE

Gigartina canaliculata Harv. Attached to cobble; mid to lower intertidal; uncommon; 1, 3; *Capelli et al. VRD 19-87, 75-88, 76-88, 77-88* (UCSB).

Gigartina corymbifera (Kütz) J. Ag. Attached to cobble; lower intertidal to subtidal; uncommon; 1, 7, 8, 9; *Capelli et al. VRD 20-87, 21-87, 22-87, 78-88, 79-88, 80-88, 27-89* (UCSB).

Gigartina exasperata Harv. & Bail. Attached to cobble; low intertidal; common; 2 (subtidal), 3 (subtidal), 5, 9; *Capelli et al.* and *Capelli* and *Douros VRD 81-88, 82-88, 83-88, 84-88, 28-89, 29-89, 30-89, 31-89, 32-89, 33-89, 34-89, 35-89* (UCSB).

Gigartina harveyana (Kütz) Attached to cobble; lower intertidal; abundant; 2 (subtidal); *Capelli* and *Douros VRD 36-89, 37-89, 38-89, 39-89, 40-89, 41-89, 42-89, 43-89* (UCSB).

Gigartina leptorhynchos J. Ag. Attached to cobble; high to low intertidal; abundant; 1, 7, 8; *Capelli et al. VRD 23-87, 85-88, 86-88, 87-88, 88-88* (UCSB); *Dawson 15760, 17306, 20715, 20733* (LAM).

Gigartina papillata (C. Ag.) J. Ag. Attached to cobble; mid to low intertidal; common; 3, 4, 7; *Capelli et al. VRD 89-88, 90-88, 91-88, 92-88, 93-88* (UCSB).

Gigartina spinosa (Kütz) Harv. Attached to cobble; mid to low intertidal; common; 8, 9; *Capelli et al. VRD 94-88, 95-88, 96-88, 97-88* (UCSB).

Gigartina volans (C. Ag.) Attached to cobble; low intertidal to subtidal; common; 2 (subtidal), 3, 4, 5, 9; *Capelli et al.* and *Capelli* and *Douros VRD 24-87, 25-87, 98-88, 99-88, 100-88, 101-88, 102-88, 103-88, 44-89, 45-89* (UCSB); *Dawson 15771* (LAM).

Gigartina sp. Attached to cobble; low intertidal to subtidal; common; 1, 3, 4, 9; *Capelli et al.* and *Capelli* and *Douros VRD 26-87, 104-88, 105-88, 106-88, 107-88, 108-88, 109-88, 46-89* (UCSB).

Rhodoglossum affine (Harv.) Kyl. Attached to cobble; mid to low intertidal; occasional; 8, 9; *Capelli et al. VRD 180-88, 181-88* (UCSB).

Rhodoglossum californicum (J. Ag.) Abb. Attached to cobble; mid to low intertidal; occasional; 9; *Capelli et al. VRD 182-88* (UCSB).

Family GRACILARIACEAE

Gracilaria andersonii (Grun.) Kyl. Attached to cobble exposed and buried; low intertidal to subtidal; common; *Dawson* (=*Gracilariopsis*) *15759, 17292* (LAM).

Gracilaria sjoestedtii Kyl. Attached to cobble exposed and buried in sand; mid to low intertidal; common; 1, 2 (subtidal), 3 (subtidal), 5, 9; *Capelli et al.* and *Capelli* and *Douros VRD 110-88, 111-88, 112-88, 113-88, 114-88, 115-88, 47-89, 48-89, 49-89, 50-89* (UCSB); *Dawson* (=*Gracilariopsis sjoestedtii*) *17302, 17307, 20708, 20724* (LAM).

Gracilaria textorii var. cunninghamii (Farl.) Daws. Attached to cobble; low intertidal; occasional; *Dawson* (=*G. cunninghamii*) *15772, 20729.*

Gracilaria verrucosa (Huds.) Papenf. Attached to cobble and in sand; mid to low intertidal; uncommon; 1, 5, 9; *Capelli et al. VRD 116-88, 117-88, 118-88, 119-88, 120-88, 121-88, 122-88* (UCSB).

Gracilariophila oryzoides Setch. & Wils. Parasitic on Gracilaria sp.; low intertidal to subtidal; common; *Dawson 20709* (LAM).

Family PHYLLOPHORACEAE

Ahnfeltia gigartinoides J. Ag. Attached to cobble; mid to low intertidal; common; 1, 5; *Capelli et al. VRD 45-88, 46-88* (UCSB).

Ahnfeltia plicata (Huds.) Fries. Attached to cobble; mid to low intertidal; common; 2, 7, 9; *Capelli et al. VRD 47-88, 48-88, 49-88* (UCSB).

Gymnogongrus leptophyllus J. Ag. Attached to cobble; mid to low intertidal; common; 5; *Capelli et al. 144-88, 145-88* (UCSB); *Dawson 15752, 15762, 17294, 17310, 20711, 20728* (LAM).

Gymnogongrus platyphyllus Gardn. Attached to cobble; low intertidal to subtidal; occasional; 2 (subtidal); *Capelli* and *Douros VRD 64-89* (UCSB).

Gymnogongrus sp. Attached to cobble; mid to low intertidal; occasional; 8, 9; *Capelli et al. VRD 35-87, 36-87* (UCSB).

Stenogramme interrupta (C. Ag.) Mont. Attached to cobble exposed and buried in sand; subtidal; rare; 2 (subtidal); *Capelli* and *Douros VRD 95-89* (UCSB); *Dawson 15781, 17321, 20726* (LAM).

Ozophora clevelandii (Farl.) Abb. Attached to cobble; subtidal; uncommon; *Dawson* (=*Phyllophora californica*) *15780* (LAM).

Family PLOCAMIACEAE

Plocamium cartilagineum (L.) Dix. Attached to cobble exposed and buried; low intertidal to subtidal; common; 3 (subtidal), 9; *Capelli et al.* and *Capelli* and *Douros VRD 37-87, 38-87, 160-88, 71-89, 72-89, 73-89, 74-89, Dawson* (=P. *pacificum*) *17301, 17317* (LAM).

Family SOLIERIACEAE

Neoagardhiella baileyi (Kütz) Attached to cobble; mid to low intertidal; common; 3; *Capelli et al. VRD 156-88* (UCSB); *Dawson* (=*Agardhiella coulteri*) *15754, 15763, 20722* (LAM).

Class BANGIOPHYCEAE

Order BANGIALES

Family BANGIACEAE

Porphyra lanceolata (Setch. & Hus) Smith Attached to cobble; mid to low intertidal; occasional; 6, 9; *Capelli et al. VRD 39-87, 40-87* (UCSB).

Porphyra perforata J. Ag. Attached to cobble; mid to low intertidal; common; 1, 3, 4, 8, 9; *Capelli et al. VRD 41-87, 166-88, 167-88, 168-88, 169-88, 170-88, 171-88* (UCSB); *Dawson 17290, 17303* (LAM).

Family ERYTHROPELTIDACEAE

Smithora naiadum (Anders.) Hollenb. Epiphytic on *Phyllospadix spp.*; low intertidal to subtidal; common; 1, 9; *Capelli et al. VRD 184-88, 185-88, 186-88* (UCSB).

APPENDIX VII

CHECKLIST OF MARINE ALGAE FROM THE VENTURA RIVER DELTA:

INTERTIDAL WETLANDS AND NEAR SHORE SUBTIDAL

DEEPWATER HABITATS

CHECKLIST OF MARINE ALGAE FROM THE VENTURA RIVER DELTA: INTERTIDAL WETLANDS AND NEAR SHORE SUBTIDAL

Acrosorium uncinatum (Turn.) Kyl.

Ahnfeltia gigartinoides J. Ag.
Ahnfeltia plicata (Huds.) Fries.

Bossiella orbigniana (Dec.) Silva
Bossiella sp.

Botryoglossum farlowianum (J. Ag.) DeToni.

Bryopsis corticulans Setch.

Callophyllis flabellulata Harv.
Callophyllis obtusifolia J. Ag.
Callophyllis violacea J. Ag.
Callophyllis sp.

Centroceras clavulatum (C. Ag.) Mont.

Ceramium californicum J. Ag.
Ceramium pacificum (Coll.) Kyl.
Ceramium sp.

Chaetomorpha linum (Müll.) Kütz

Chondria decipiens Kyl.
Chondria nidifica Harv.
Chondria sp.

Cladophora columbiana Coll.
Cladophora microcladiodes Coll.
Cladophora sakii Abb.
Cladophora sp.

Codium setchellii Gardn.

Colpolmenia peregrina (Sauv.) Ham.

Corallina vancouveriensis Yendo.

Cryptonemia obovata J. Ag.

Cryptopleura violacea (J. Ag.) Kyl.

Cryptosiphonia woodii (J. Ag.) J. Ag.

Cumagloia andersonii (Farl.) S. & G.

Cystoseira osmundacea (Turn.) C. Ag.

Desmarestia ligulata (Lightf.) Lamour.

Ectocarpus parvus (Saund.)
Ectocarpus sp.

Egregia australis (Daw.)
Egregia menziesii (Turn.)

Enteromorpha clathrata (Roth) Grev.
Enteromorpha compressa (L.) Grev.
Enteromorpha intestinalis (L.) Link
Enteromorpha linza (L.) J. Ag.
Enteromorpha sp.

Erythroglossum californicum (J. Ag.) J. Ag.

Farlowia mollis (Harv. & Bail.) Farl. & Setch.

Gastroclonium coulteri (Harv.) Kyl.

Gelidium coulteri Harv.
Gelidium pusillum (Stackh.) Le Jol

Gigartina canaliculata Harv.
Gigartina corymbifera (Kütz) J. Ag.
Gigartina exasperata Harv. & Bail.
Gigartina harveyana (Kütz)
Gigartina leptorhynchos J. Ag.
Gigartina papillata (C. Ag.) J. Ag.
Gigartina spinosa (Kütz) Harv.
Gigartina volans (C. Ag.) J. Ag.
Gigartina sp.

Gracilaria andersonii (Grun.) Kyl.
Gracilaria sjoestedtii Kyl.
Gracilaria textorii var. cunninghamii (Farl.) Daws.
Gracilaria verrucosa (Huds.) Papenf

Gracilariophila oryzoides Setch. & Wils.

Grateloupia doryphra (Mont.)
Grateloupia filicina (Lamour.) C. Ag.
Grateloupia setchellii Kyl.
Grateloupia sp.

Gymnogongrus leptophyllus J. Ag.
Gymnogongrus platyphyllus Gardn.
Gymnogongrus sp.

Janczewskia lappacea Setch.

Laurencia spectabilis var. *diegoensis* (Daws.) Daws.

Leptocladia binghamiae J.Ag.
Leptocladia sp.

Macrocystis pyrifera (L.) C. Ag.

Melobesia mediocris (Fosl.) Setch. & Mason

Microcladia californica (Farl.

Myriogramme spectabilis (Eat.) Kyl.

Nemalion helminthoides (Vell.) Batt.

Neoagardhiella baileyi (Kütz)

Niemburgia andersoniana (J. Ag.) Kyl.

Ozophora clevelandii (Farl.) Abb.

Phycodrys setchellii Skottsb.

Plenosporium squarrulosum (Harv.) Abb.

Plocamium cartilagineum (L.) Dik.

Polyneura latissima (Harv.) Kyl.

Polysiphonia paniculata Mont.
Polysiphonia spp.

Porphyra lanceolata (Setch. & Hus) Smith
Porphyra perforata J.Ag.

Prionitis angusta (Harv.)
Prionitis australis (J. Ag.) J. Ag.

Pterocladia sp.

Pterosiphonia baileyi (Harv.) Falk.
Pterosiphonia dendroidea (Mont.) Falk.

Ralfsia pacifica Hollenb.

Rhodoglossum affine (Harv.) Kyl.
Rhodoglossum californicum (J. Ag.) Abb.

Rhodymenia californica Kyl.
Rhodymenia pacifica Kyl.

Sargassum muticum (Yendo) Fensh.

Smithora naiadum (Anders.) Hollenb.

Stenogramme interrupta (Farl.)

Ulva angusta S. & G.
Ulva californica Wille
Ulva costata (Howe) Hollenb.
Ulva lactuca L.
Ulva lobata (Kütz) S. & G.
Ulva taeniata (Setch.) S. & G.
Ulva sp.

APPENDIX VIII

ANNOTATED CATALOGUE OF THE VASCULAR PLANTS:

EMMA WOOD STATE BEACH

AND THE VENTURA RIVER ESTUARY

ANNOTATED CATALOGUE OF THE VASCULAR PLANTS

The Annotated Catalogue includes all native, naturalized, and planted species of vascular plants found by the authors (1) in the immediate vicinity of the Ventura River Delta, including Seaside Wilderness Park, Emma Wood State Beach, and the Hubbard Property, or (2) supported by specimens housed at several herbaria including those at the University of California, Santa Barbara (UCSB), Santa Barbara Botanic Garden (SBBG), Santa Barbara Museum of Natural History (SBM) now housed at SBBG, and the California Academy of Sciences (CAS), which also contains the Dudley Herbarium (DS). The catalogue is arranged phylogenetically for ferns, gymnosperms, and angiosperms; thereafter, families, genera, species, and infraspecific taxa are arranged alphabetically.

Included for each taxon are scientific name, common name, occurrence/abundance (abundant, common, scattered, occasional, uncommon, and rare), habit (annual, biennial, perennial, herb, vine, grass, fern, shrub, and tree), habitat, vegetation type, flowering period, collection number , and "naturalized" or "planted" if not native. Occurrence refers to the frequency in which the plant occurs in the study area, whereas abundance identifies the density at local sites. Habitat indicates the kind of place where the plant was found. Within this category, alluvial (deltaic) terrace habitats are equivalent to flood plains.

Vegetation type refers to the dominant plant associations noted for the individual taxa and follows a modified version of Cowardin et al. (1979) for wetlands and Holland (1986) for uplands. The collection number is the voucher specimen collection number for taxa deposited in the UCSB Herbarium in addition to vouchers housed at SBBG and CAS. Each voucher citation includes the collector(s) name, collection number (or s.n. and collection date if no collection number has been assigned), and repository (herbarium) acronym. Several species are known from the study area only by: (1) reports from Munz (1974) or Smith (1976); (2) the collections of E. Yale Dawson (1956) housed at LAM; (3) citations from Henry Minter Pollard, who indicated various plants occurred in or adjacent to the study area as recorded in a card file (PCF) housed at SBBG and usually supported by specimens housed at CAS, SBBG, and UCSB. Occasional card file citations are documented by Pollard vouchers observed by the authors; however, many citations are not represented by vouchers because additional herbarium searches will be necessary to locate Pollard collections. Occasional species observed in the field during this study by the Environmental Research Team, and for which there are no vouchers, have no specimen citations, but are identified by: (ERT 1986-1989).

Naturalized taxa are those that either escaped from cultivation or were otherwise purposefully or incidentally introduced from areas beyond California, such as Europe. Several taxa were purposefully planted within the study area and persist on-site without supplemental care, such as Monterey Cypress (*Cupressus macrocarpa*). All non-native taxa (naturalized and planted) are indicated by an asterisk "*" preceding the scientific name.

ANNOTATED CATALOGUE OF VASCULAR PLANTS

DIVISION TRACHEOPHYTA

SUBDIVISION SPHENOPSIDA

CLASS EQUISETAE

ORDER EQUISETALES

EQUISETACEAE Horsetail Family

Equisetum laevigatum A. Br. Smooth Scouring Rush. Rhizomatous perennial; rare/(locally extirpated?); river banks, river mouth; Riverine Emergent Wetland, Palustrine Emergent Wetland; FEB-JUL; *Pollard s.n.* 21 OCT 1945, 3 MAR 1946 (CAS).

Equisetum telmateia Ehrh. var. *braunii* Milde. Braun's Giant Horsetail. Rhizomatous perennial; rare/(locally extirpated?); railroad; Ruderal Habitats, Palustrine Emergent Wetland; FEB-SEP; *Pollard s.n.* 10 FEB 1946 (CAS).

ORDER SALVINIALES

SALVINIACEAE Salvinia Family

Azolla filiculoides Lam. Duckweed Fern. Annual free-floating fern; uncommon/common seasonally; river channel bed, vicinity of Main Street, upper reach of estuary; Riverine Aquatic Bed Wetland; JUN-OCT; *Magney VR-74-87* (UCSB), *Pollard s.n.* 22 SEP 1945 (CAS).

SUBDIVISION PTEROPHYTA

CLASS CONIFERAE

ORDER CONIFERALES

CUPRESSACEAE Cypress Family

**Cupressus macrocarpa* Hartw. ex Gord. Monterey Cypress. Tree; uncommon/common; planted and naturalized at Seaside Wilderness Park south of railroad tracks and west of the river estuary; (ERT 1986-1989), *Pollard s.n.* 2 OCT 1959, 1 DEC 1969 (CAS).

CLASS ANGIOSPERMAE

SUBCLASS DICOTYLEDONEAE

AIZOACEAE Carpet-weed or Ice-plant Family

*Carpobrotus aequilaterus (Haw.) N. E. Brown. [Mesembryanthemum a. Haw.; M. chilensis Mol.; Carpobrotus c. (Mol.) N. E. Br.]. Sea-fig. Mat-forming succulent shrub; uncommon/common; cobble beach berm and sandy habitats such as the coastal sand dunes; Southern Coastal Dunes; MAR-SEP; *Ferren & Capelli VR177* (UCSB), *Pollard s.n.* 13 OCT 1945 (SBBG), 10 NOV 1945, 4 AUG 1970 (PCF).

*Carpobrotus edulis (L.) Bolus [Mesembryanthemum edule L.]. Hottentot Fig. Mat-forming succulent shrub; common/common; cobble beach berm and sandy habitats such as the coastal sand dunes within Emma Wood State Beach; Southern Coastal Dunes; MAR-OCT; *Magney et al. VR138, VR140* (UCSB), *Pollard s.n.* 10 NOV 1945, 4 AUG 1970 (SBBG).

*Malephora crocea (Jacq.) Schwantes. Croceum Ice-plant. Succulent trailing shrub; rare/rare; flood plain near river mouth; MAR-OCT; *Pollard s.n.* 13 AUG 1949 (PCF).

*Mesembryanthemum crystallinum L. [Gasoul c. (L.) Rotm.]. Common Ice-plant. Fleshy annual herb; rare/rare; sandy beach, disturbed habitats; Southern Coastal Dunes; MAR-OCT; *Pang 40* (UCSB), Pollard *s.n.* 10 NOV 1945 (PCF), 13 JUN 1946, 4 AUG 1970 (SBBG).

*Mesembryanthemum nodiflorum L. [Gasoul n. (L.) Rotm.]. Slender-leaved Ice-plant. Fleshy annual herb; rare/rare; sandy beach, disturbed habitats, dune swale; Palustrine Emergent Wetland, Ruderal Habitats; APR-NOV; *Pang 37* (UCSB), *Pollard s.n.* 13 JUN 1946, 4 AUG 1970 (SBBG).

*Tetragonia tetragonioides (Pallas) Kuntze [T. expansa Murr.]. New Zealand Spinach. Mat-forming succulent annual herb; uncommon/abundant; dune swale wetland, cobbly beach and beach swale wetland, open disturbed sandy habitats, Emma Wood State Beach and Seaside Wilderness Park; Palustrine Emergent Wetland, Palustrine Scrub/Shrub Wetland, Southern Coastal Dunes, Ruderal Habitats; APR-SEP; *Magney et al. VR-150-87* (UCSB), *Pollard s.n.* 29 SEP 1945 (PCF).

AMARANTHACEAE Amaranth Family

*Amaranthus albus L. [A. graecizans L.]. Tumbleweed. Annual herb; rare/rare; disturbed habitats; Ruderal Habitats, Palustrine Scrub/Shrub Wetland; MAY-OCT, (ERT 1986-1989).

*Amaranthus deflexus L. Prostrate Amaranth. Annual herb; rare/rare; roadside at mouth of river, disturbed habitats; Ruderal Habitats; MAY-NOV; *Pollard s.n.* 22 SEP 1945 (PCF).

ANACARDIACEAE Sumac Family

Malosma laurina Nutt. ex Abrams [*Rhus l.* Nutt. in T. & G.]. Laural Sumac, Laurel-leaf Sumac. Shrub; rare/rare; alluvial (deltaic) terrace, sandy substrates; Palustrine Scrub/Shrub Wetland; JUN-JUL; *Rindlaub et al. VR54*, *VR107* (UCSB).

Rhus integrifolia (Nutt.) Benth. & Hook. Lemonadeberry. Shrub; rare/rare; river bank, beach W. of river mouth, alluvial (deltaic) terrace; Palustrine Scrub/Shrub Wetland; FEB-MAY; *Magney et al. VR112* (UCSB), *Pollard s.n.* 10 NOV 1945, 3 MAR 1946, 23 NOV 1947 (PCF).

Toxicodendron diversilobum (T. & G.) Greene [*Rhus diversiloba* T. & G.]. Poison Oak. Shrub/vine; scattered/common; alluvial (deltaic) terrace, cobbly beach and dune swale wetland, abandoned temporary channels, shaded sites such as under Main Street Bridge, Emma Wood State Beach; Palustrine Scrub/Shrub Wetlands, Palustrine Forested Wetland; APR-MAY; (ERT 1986-1989).

APIACEAE Carrot Family

**Apium graveolens* L. Celery. Perennial herb; rare/scattered; channel and river bed, along river bank such as under Main Street Bridge; Riverine Emergent Wetland, Palustrine Emergent Wetland; MAY-JUL; *Rindlaub et al. VR32* (UCSB), *Pollard s.n.* 13 OCT 1944, 27 OCT 1945 (PCF).

Berula erecta (Huds.) Cov. Water-parsnip. Perennial herb; uncommon/occasional; channel and river bed, along river bank such as under Main Street Bridge; Riverine Emergent Wetland; JUN-SEP; *Magney & Ferren VR-85-87* (UCSB).

**Conium maculatum* L. Poison Hemlock. Annual herb; scattered/ common; exposed riverbed and bars, dune swale wetland, alluvial (deltaic) terrace, abandoned temporary channels, in previously disturbed habitats of Emma Wood State Beach, on berm of drainage ditch north of Main Street; Palustrine Scrub/Shrub Wetlands, Ruderal Habitats; APR-SEP; *Rindlaub et al. VR27*, *VR48*, *Pang 36* (UCSB).

**Foeniculum vulgare* Mill. Sweet Fennel. Perennial herb; scattered/common; exposed riverbed and bars, cobbly beach and dune swale wetland, alluvial (deltaic) terrace, abandoned temporary channels, in old disturbance areas, occurring throughout study area; Palustrine Scrub/Shrub Wetland, Ruderal Habitats; MAY-SEP; *Magney et al. VR113* (UCSB).

ASTERACEAE Sunflower Family

Amblyopappus pusillus H. & A. Native Pineapple Weed. Annual; rare/(locally extirpated?); sandy flat, beach, near mouth of river; bluffs W. of river; MAR-MAY; *Pollard s.n.* 14 APR 1946, 6 JUN 1948, 21 JUN 1960 (PCF), C. Smith (1976).

Ambrosia chamissonis Less. ssp. *bipinnatisecta* Greene [*Franseria c.* ssp. *b.* Less.]. Beach-bur (Fig. VIII-1). Perennial herb; scattered/common; primary dunes, forming loose mats in sand dunes, Emma Wood State Beach; Southern Coastal Dunes; JUL-NOV; *Magney et al. VR139* (UCSB), *Pollard s.n.* 22 SEP 1945, 21 OCT

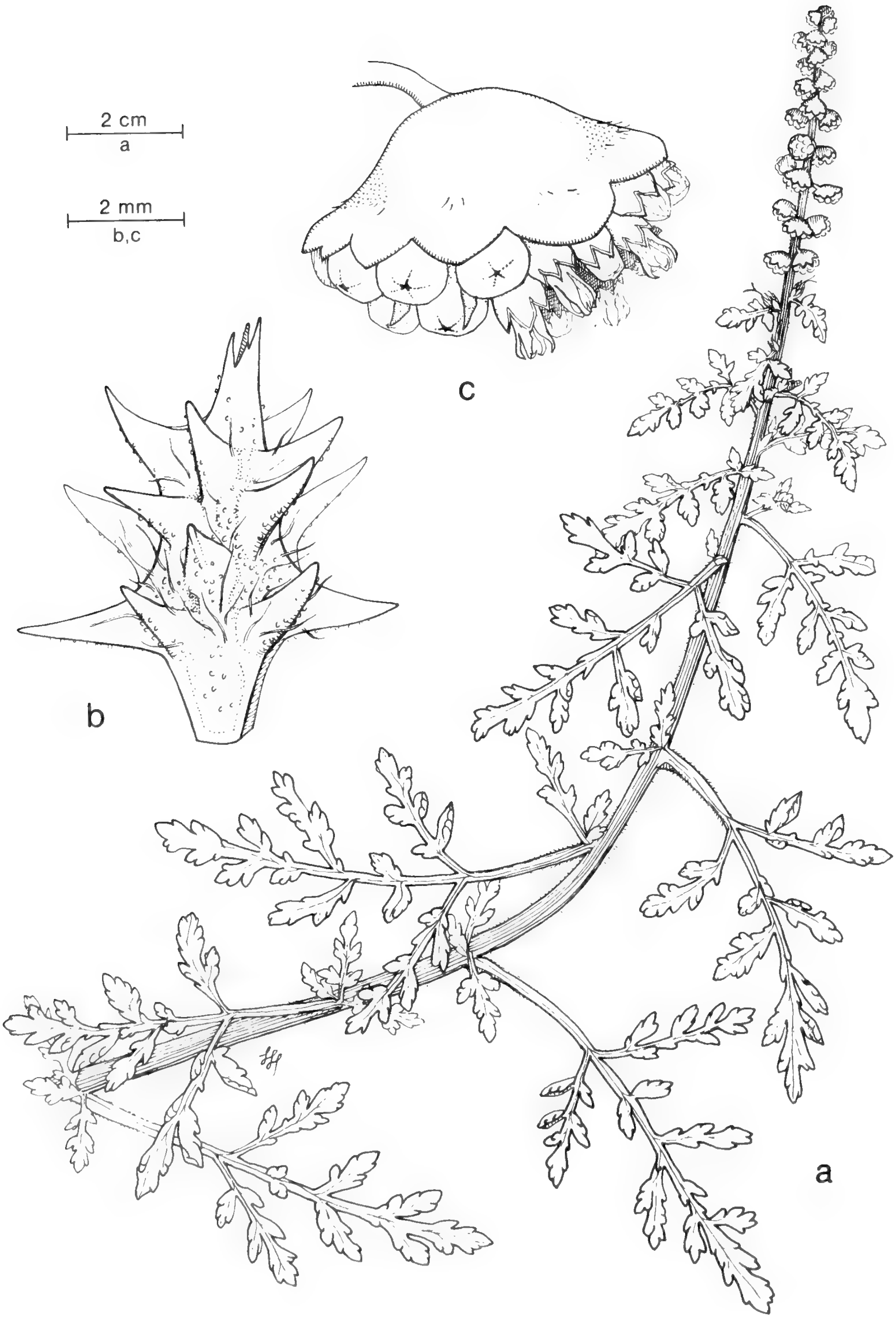

FIG. VIII-1. *Ambrosia chamissonis* (Less.) Greene. Silver Beachweed.
a. Decumbent stem. b. Spiny involucre of mature pistillate flower.
c. Capitulum (head) of staminate flowers.

1945, 4 AUG 1970 (PCF).

Ambrosia psilostachya DC. var. *californica* (Rydb.) Blake. Western Ragweed. Perennial herb; exposed riverbed and bars, alluvial (deltaic) terrace, abandoned temporary channels, open and previously disturbed habitats, drier sites of study area, on terrace next to river at Main Street; Ruderal Habitats, Southern Coastal Dunes, Palustrine Scrub/Shrub Wetland; JUL-NOV; *Magney et al. VR-131-87* (UCSB).

**Anthemis cotula* L. Mayweed. Annual herb; rare/uncommon; exposed riverbed and bars, previously disturbed sites such as north of Main Street; Ruderal Habitats, Palustrine Scrub/Shrub Wetland; APR-AUG; (ERT 1986-1989), *Pollard s.n.* 4 JUN 1964 (PCF).

**Artemisia biennis* Willd. Marsh Sagebrush. Biennial herb; scattered/common; dune swale wetland, moist soil at edge of estuary, riverbed, salt marsh; Seaside Wilderness Park, Emma Wood State Beach; Palustrine Emergent Saline Wetland, Estuarine Scrub/Shrub Wetland; AUG-OCT; *Magney & Ferren VR-139-86, Magney et al. VR-156-87* (UCSB), *Pollard s.n.* 6 OCT 1945, 13 OCT 1965, 4 NOV 1971 (PCF).

Artemisia californica Less. California Sagebrush. Shrub; uncommon/uncommon; alluvial (deltaic) terrace, in flood plain area above Highway 101; Palustrine Scrub/Shrub Wetland; AUG-DEC; *Rindlaub et al. VR21* (UCSB), *Pollard s.n.* 2 DEC 1971 (PCF).

Artemisia douglasiana Bess. in Hook. Mugwort. Perennial herb; occasional/common; river channel margins, exposed riverbed and bars, dune swale wetland, abandoned temporary channels, alluvial (deltaic) terrace, shaded habitats in seasonally moist substrates; Palustrine Scrub/Shrub Wetland, Palustrine Forested Wetland; JUN-OCT; *Rindlaub et al. VR22, Magney et al. VR157, Magney & Ferren VR-84-87* (UCSB).

Artemisia dracunculus L. [*Artemisia dracunculoides* Pursh]. Tarragon. Rhizomatous perennial herb; rare/rare; exposed riverbed and bars in flood plain area above Highway 101; Palustrine Scrub/Shrub Wetland; AUG-OCT; *Magney et al. VR105* (UCSB).

Aster subulatus Michx. var. *ligulatus* Shinners. [*A. exilis* Ell.]. Slender Marsh Aster. Annual herb; scattered/scattered; estuary margins, on bar in rocky mudflats of estuary; Estuarine Nonpersistent Emergent Wetland, Estuarine Scrub/Shrub Wetland; SEP-NOV; *Magney & Ferren VR-135-86, Magney et al. VR-151-87* (UCSB), *Pollard s.n.* 4 NOV 1971 (SBBG), *Pollard s.n.* 6 OCT 1945, 13 OCT 1965 (PCF).

Baccharis douglasii DC. Salt Marsh Baccharis (Fig. VIII-2). Perennial herb; rare/uncommon; river mouth swale wetland east of estuary, Seaside Wilderness Park, and marsh behind sand dune and along second river mouth estuary, Emma Wood State Beach; Palustrine Emergent Wetland, Estuarine Emergent Wetland; JUL-OCT; (ERT 1986-1989), *Pollard s.n.* 7 NOV 1948 (PCF), 13 OCT 1945, 4 AUG 1970, 4 NOV 1971 (SBBG).

Baccharis pilularis DC. ssp. *consanguinea* (DC). C.B.Wolf. Coyote Brush (Fig. VIII-3). Shrub; scattered/common; cobbly beach and dune swale wetland, alluvial

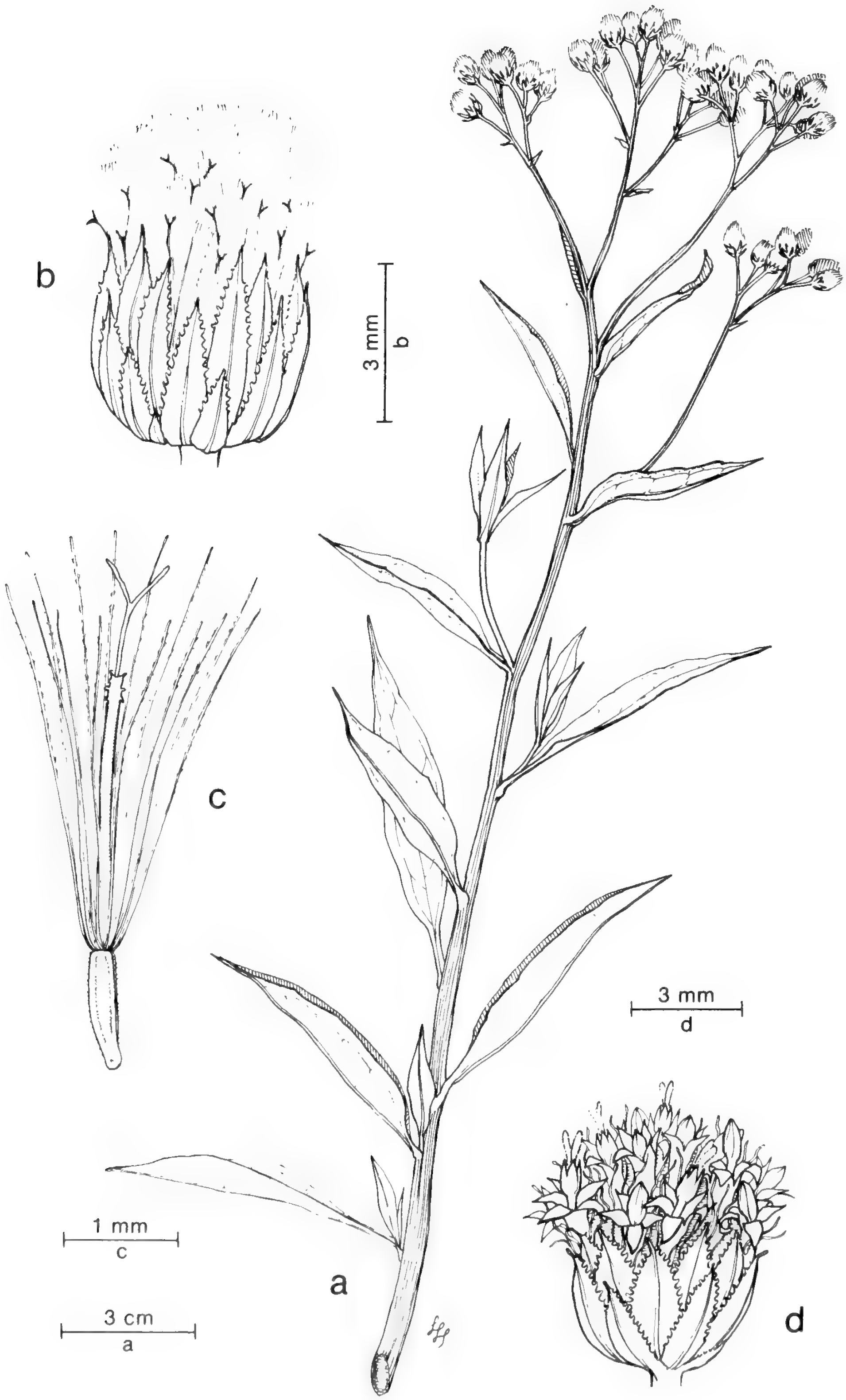

FIG. VIII-2. *Baccharis douglasii* DC. Salt Marsh Baccharis.
a. Upper stem, arrangement of capitula, female plant. b. Capitulum of pistillate flowers. c. Pistillate flower with bristles and developing achene. d. Capitulum of staminate flowers.

FIG. VIII-3. *Baccharis pilularis* DC. ssp. *consanguinea* (DC). C.B. Wolf. Coyote Brush. a. Branch, arrangement of capitula, female plant. b. Capitulum of pistillate flowers. c. Pistillate flower with bristles and developing achene. d. Capitulum of staminate flowers.

(deltaic) terrace, abandoned temporary channels, in sandy and rocky flood plain habitats such as on east side of river above and below Highway 101; Palustrine Scrub/Shrub Wetland; AUG-DEC; *Magney et al. VR104* (UCSB), *Pollard s.n.* 10 NOV 1971 (PCF).

Baccharis plummerae Gray. Plummer's Baccharis. Shrub; rare/(locally extirpated?); weedy shoreline of estuary; JUN-OCT; *Pollard s.n.* 13 OCT 1965 (PCF, SBBG).

Baccharis salicifolia (Ruiz & Pavon) Pers. [*B. glutinosa* Pers.; *B. viminea* DC.]. Mule Fat, Water Wally, Seep-willow. Shrub; common/common; river channel margins, exposed riverbed and bars, cobbly beach and dune swale wetland, alluvial (deltaic) terrace, abandoned temporary channels, and margin of estuary, Seaside Wilderness Park, Emma Wood State Beach, riverbanks and flood plain above and below Highway 101; Palustrine Scrub/Shrub Wetland, Estuarine Scrub/Shrub Wetland; JAN-DEC; *Rindlaub et al. VR4* (UCSB), *Pollard s.n.* 10 NOV 1971 (PCF).

**Carduus pycnocephalus* L. Italian Thistle. Annual herb; scattered/common; dune swale wetland, alluvial (deltaic) terrace, back dune swale area of Emma Wood State Beach, open disturbed habitats of flood plain area above Highway 101; Ruderal Habitats, Palustrine Scrub/Shrub Wetland; MAY-JUL; *Pang 29* (UCSB).

**Centaurea melitensis* L. Tocalote. Annual herb; scattered/common; exposed riverbed and bars, alluvial (deltaic) terrace, abandoned temporary channels, sand dunes, and ruderal areas throughout higher ground of study area, including Emma Wood State Beach and areas of flood plain above Highway 101; Ruderal Habitats, Palustrine Scrub/Shrub Wetland, Palustrine Forested Wetland; MAY-JUN; *Magney et al. VR100* (UCSB).

**Centaurea repens* L. Russian Knapweed. Perennial herb; rare/scattered; roadside at river mouth; Ruderal Habitats; *Pollard s.n.* 22 SEP 1945 (PCF).

**Centaurea solstitialis* L. Yellow Star Thistle, Barnaby's Thistle. Annual herb; rare/uncommon; exposed riverbed and bars, open areas of flood plain above Highway 101; MAY-OCT; *Pollard s.n.* 10 NOV 1971 (PCF).

**Cichorium intybus* L. Chicory. Perennial herb; rare/rare; abandoned temporary channels, one plant found in drainage ditch east of river just above Main Street; Ruderal Habitats; JUN-OCT; *Magney & Ferren VR-66-87* (UCSB).

Cirsium brevistylum Cronquist. Indian Thistle. Perennial herb; uncommon/scattered; open space in grove W. of estuary; railroad; MAY-AUG; *Pollard s.n.* 13 JUN 1946, 23 APR 1953, 27 MAY 1967 (PCF, SBBG).

**Cirsium vulgare* (Savi) Ten. Bull Thistle. Biennial herb; rare/rare; dune swale wetland, exposed riverbed and bars, back dune swale area of Emma Wood State Beach, open areas of flood plain above Highway 101; Palustrine Scrub/Shrub Wetland; JUN-SEP; *Pang 29* (UCSB).

**Conyza bonariensis* (L.) Cronq. South American Horseweed. Annual herb; rare/rare; exposed riverbed and bars, open area of flood plain above Highway 101; Palustrine Scrub/Shrub Wetland; JUN-AUG; *Rindlaub et al. VR37b* (UCSB).

Conyza canadensis (L.) Cronq. Common Horseweed. Annual herb; common/common; exposed riverbed and bars, alluvial (deltaic) terrace, exposed channel margins and beds, throughout study area, Seaside Wilderness Park, Emma Wood State Beach; Palustrine Scrub/Shrub/Emergent Wetland, Riverine Emergent Wetland; JUN-SEP; (ERT 1986-1989).

Conyza coulteri Gray. Marsh Horseweed. Annual herb; uncommon/occasional; dune swale wetland, along railroad bank near second mouth in moist silty soil, Emma Wood State Beach; Palustrine Scrub/Shrub Wetland; MAY-OCT; *Magney & Ferren VR-138-86, Magney VR-127-87, Magney et al. VR-157-87* (UCSB).

Corethrogyne filaginifolia (H. & A.) Nutt. var. *virgata* (Benth.) Gray. Virgate Cudweed-aster. Perennial herb; occasional/uncommon; alluvial (deltaic) terrace, sandy flood plain area above Main Street; Coastal Sage Scrub, Palustrine Scrub/Shrub Wetland; JUL-OCT; *Magney & Ferren VR-67-87* (UCSB).

**Cotula coronopifolia* L. Brass-buttons. Annual or perennial herb; uncommon/common; channel margins and bed, estuary margins, in mudflats of estuary, at Highway 101, in open areas of dune swale wetland and disturbed areas, Seaside Wilderness Park, Emma Wood State Beach; Riverine Emergent Wetland, Estuarine Nonpersistent Emergent Wetland, Palustrine Emergent Wetland; MAR-DEC; *Rindlaub et al. VR39, Magney et al. VR149, Pang 26* (UCSB), *Pollard s.n.* 23 MAR 1947, 17 NOV 1961 (PCF).

**Eclipta alba* (L.) Hassk. Eclipta. Annual; uncommon/uncommon; river channel margin, estuary margin along bar at mouth, Seaside Wilderness Park; Riverine Emergent Wetland, Estuarine Nonpersistent Emergent Wetland; *Ferren & Capelli VR179* (UCSB).

Encelia californica Nutt. California Bush Sunflower. Shrub; rare/rare; coastal dunes and alluvial (deltaic) terrace, above Main Street; Southern Coastal Dunes, Palustrine Scrub/Shrub Wetland; FEB-JUL (NOV); *Magney et al. VR121* (UCSB), *Pollard s.n.* 29 SEP 1945, 2 MAR 1947 (PCF).

Eriophyllum confertiflorum (DC.) Gray var. *confertiflorum*. Golden Yarrow. Perennial herb; uncommon/rare; alluvial (deltaic) terrace, xeric flood plain area above Highway 101; Coastal Sage Scrub, Palustrine Scrub/Shrub Wetland; APR-AUG; *Rindlaub et al. VR43* (UCSB).

Euthamia occidentalis Nutt. [*Solidago o.* (Nutt.) T. & G.]. Western Goldenrod (Fig. VIII-4). Perennial herb; uncommon/common; margin of estuary, at second river mouth and in dune swale area of Emma Wood State Beach; Estuarine Persistent Emergent Wetland, Estuarine Scrub/Shrub Wetland, Palustrine Scrub/Shrub Wetland; JUL-NOV; *Magney & Ferren VR-97-87, Magney et al. VR132* (UCSB), *Pollard s.n.* 20 OCT 1945, 8 OCT 1964, 4 NOV 1971 (PCF).

Filago californica Nutt. California Filago. Annual herb; scattered/uncommon; exposed channel margins and bed in flood plain area above Highway 101; Riverine Emergent Wetland; MAR-JUN; *Rindlaub et al. VR62, Magney et al. VR119* (UCSB).

Gnaphalium bicolor Bioletti. Bicolored Everlasting. Biennial or perennial herb; rare/rare; railroad, alluvial (deltaic) terrace, below Highway 101; Palustrine

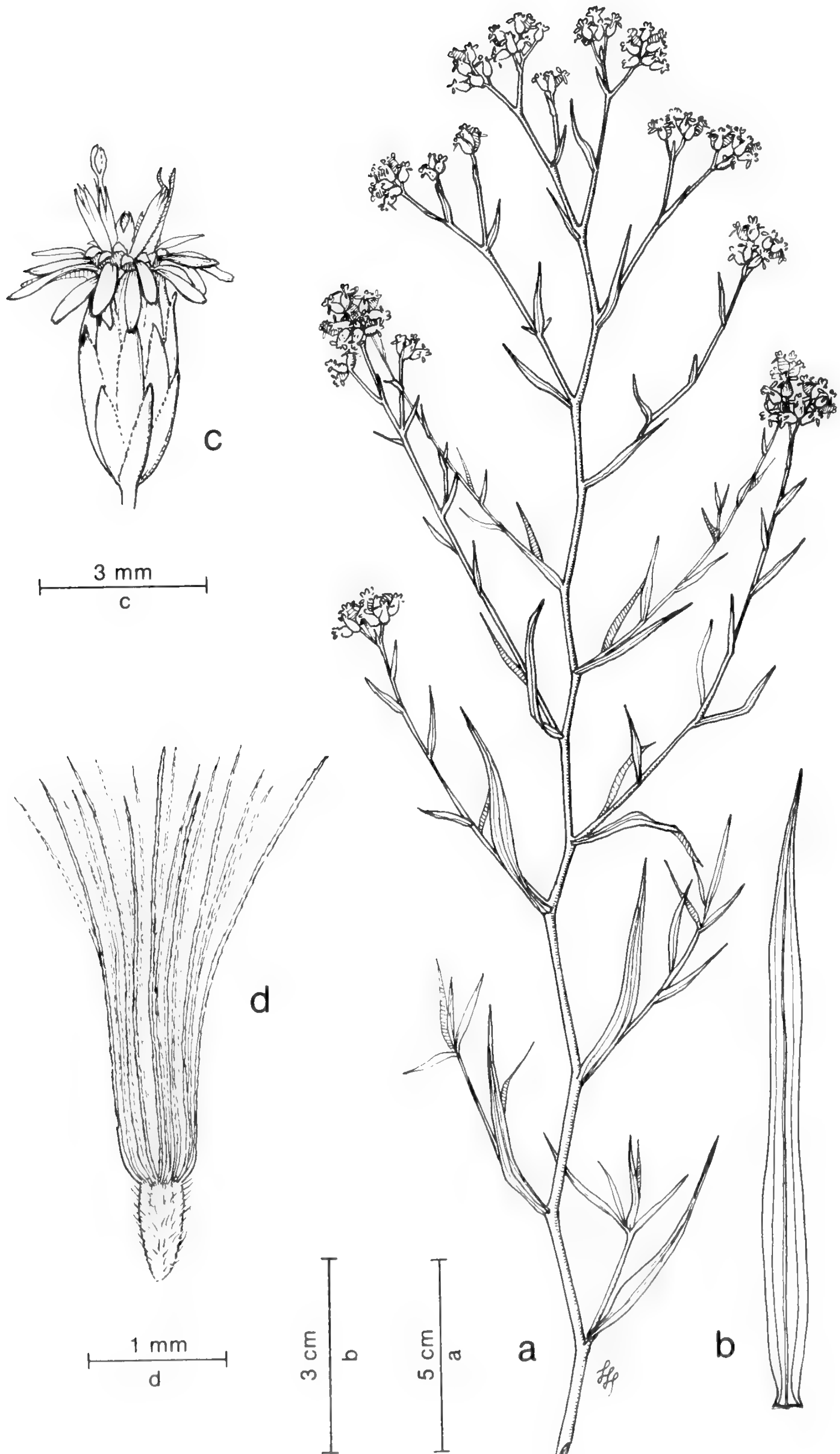

FIG. VIII-4. *Euthamia occidentalis* Nutt. Western Goldenrod.
a. Upper stem and arrangement of capitula. b. Leaf c. Capitulum. d. Achene with bristles.

Emergent Wetland, Ruderal Habitats; JAN-MAY; *Rindlaub et al. VR77* (UCSB), *Pollard s.n.* 1 DEC 1969 (PCF).

Gnaphalium californicum DC. Green Everlasting. Biennial herb; rare/rare; alluvial (deltaic) terrace, in flood plain area above Highway 101; Palustrine Scrub/Shrub Wetland; JAN-JUL; *Rindlaub et al. VR23* (UCSB).

**Gnaphalium luteo-album* L. Cudweed Everlasting. Annual herb; rare/rare; exposed channel margins and bed, in cobbles above Highway 101; Riverine Emergent Wetland; JAN-DEC; *Rindlaub et al. VR37a* (UCSB).

Gnaphalium microcephalum Nutt. White Everlasting. Biennial or perennial herb; rare/rare; exposed riverbed and bars, alluvial (deltaic) terrace, above Highway 101; Palustrine Scrub/Shrub Wetland; JUL-OCT; *Magney et al. VR117*, *Magney et al. VR-141-87* (UCSB).

Gnaphalium ramosissimum Nutt. Pink Everlasting. Biennial herb; uncommon/uncommon; border of salt marsh flat behind dunes W. of river; MAY-NOV; *Pollard s.n.* 14 AUG 1962, 12 JUL 1966 (PCF).

Hazardia squarrosa (H. & A.) Greene var. *grindelioides* (DC.) Clark [*Haplopappus squarrosus* H. & A. ssp. *g.* (DC.) Keck]. Sawtooth Goldenbush, Common Hazardia. Shrub; scattered/occasional; behind dunes, flood plain, road banks; Ruderal Habitats, Palustrine Scrub/Shrub Wetland, Coast Sage Scrub; JUL-OCT; (ERT 1986-1989), *Pollard s.n.* 20 OCT 1947, 2 OCT 1959, 10 NOV 1971 (PCF).

Helenium puberulum DC. Coast Sneezeweed. Perennial herb; rare/uncommon; channel margins and bed, in mud next to river under Main Street Bridge, salt marsh and pond W. of estuary; Riverine Emergent Wetland, Estuarine Emergent Wetland; JUN-AUG; *Magney & Ferren VR-142-86*, *Magney et al. VR-137-87* (UCSB), *Pollard s.n.* 26 JUL 1963 (PCF).

**Helianthus annuus* L. Sunflower. Annual herb; riverbed near mouth; *Pollard s.n.* 10 OCT 1948 (PCF).

Hemizonia fasciculata (DC.) T. & G. Fascicled Tarweed. Annual herb; occasional/occasional; riverbed near ocean; APR-JUL; *Pollard s.n.* 6 OCT 1945 (PCF).

Heterotheca echioides (Benth.) Shinners [*Chrysopsis villosa* (Pursh) Nutt. var. *e.* (Benth.) Gray]. Bristly Goldenaster. Perennial herb; uncommon/rare; alluvial (deltaic) terrace, exposed riverbed and bars, on sandbar alluvial scrub between Highway 101 and Main Street; Palustrine Scrub/Shrub Wetland; JUL-NOV; *Magney et al. VR-144-87 Rindlaub et al. VR63* (UCSB), *Pollard s.n.* 10 NOV 1971 (PCF).

Heterotheca grandiflora Nutt. Telegraph Weed. Annual or biennial herb; scattered/ common; beach near river mouth, exposed channel margins and bed, open sand and cobble river wash area between Highway 101 and Main Street on west-bank; Palustrine Scrub/Shrub Wetland, Riverine Emergent Wetland, Southern Coastal Dunes; JAN-DEC; *Magney et al. VR-143-87* (UCSB), *Pollard s.n.* 14 APR 1946, 3 SEP 1948 (PCF).

Holocarpha heermannii (Greene) Keck. Heermann's Tarweed. Annual herb; rare/(locally extirpated?); riverbed and flood plain near river mouth; JUN-OCT; *Pollard s.n.* 6 OCT 1945, 21 SEP 1947 (PCF).

**Hypochoeris radicata* L. Hairy Cat's Ear. Perennial herb; occasional/scattered; river bank approaching mouth; *Pollard s.n.* 21 OCT 1945 (PCF).

Isocoma veneta HBK var. *vernonioides* Jepson [*Haplopappus venetus* (H.B.K.) Blake ssp. *vernonioides* (Nutt.) Hall and var. *sedoides* (Greene) Munz]. Coastal Goldenbush (Fig. VIII-5). Shrub; common/common; dune swale wetland, cobbly beach, abandoned temporary channels, sand dunes (leeward side), road banks, railroad, Emma Wood State Beach; Palustrine Emergent Wetland, Palustrine Scrub/Shrub Wetland, Southern Coastal Dunes, Coastal Sage Scrub, Ruderal Habitats; APR-DEC; *Magney & Ferren VR-141-86*, *VR-89-87* (UCSB), *Pollard s.n.* 22 SEP 1945, 8 OCT 1964, 4 NOV 1971 (PCF).

Jaumea carnosa (Less.) Gray. Fleshy Jaumea. Succulent perennial herb; occasional/abundant; salt marsh, beach, estuary margins, river mouth swale wetland, bank of second mouth, Seaside Wilderness Park, Emma Wood State Beach; Palustrine Emergent Wetland, Estuarine Persistent Emergent Wetland; MAY-OCT; *Magney & Ferren VR-130-86, VR-94-87, Magney et al. VR161* (UCSB), *Pollard s.n.* 22 SEP 1945, 13 OCT 1945, 17 NOV 1961 (PCF).

**Lactuca serriola* L. Prickly Lettuce. Annual herb; scattered/common; many habitats throughout study area, in disturbed places; Ruderal Habitats, Palustrine Scrub/Shrub Wetland; MAY-SEP; *Pollard s.n.* 21 SEP 1947 (PCF).

Lepidospartum squamatum (Gray) Gray. Scale-broom. Shrub; common/common; exposed riverbed and bars, flood plain area above Highway 101; Palustrine Scrub/Shrub Wetland; AUG-OCT; *Rindlaub et al. VR59* (UCSB), *Pollard s.n.* 27 OCT 1945, 10 NOV 1971 (PCF).

**Madia sativa* Mol. Chilean Tarweed. Annual; occasional/scattered; flood plain near river mouth; *Pollard s.n.* 1 SEP 1947 (PCF).

Malacothrix saxatilis (Nutt.) T. & G. var. *tenuifolia* (Nutt.) Gray. Coastal Cliff-aster. Perennial herb; uncommon/scattered; alluvial (deltaic) terrace, flood plain area above Highway 101; Palustrine Scrub/Shrub Wetland, Coastal Sage Scrub; FEB-OCT; *Rindlaub et al. VR45, Magney et al. VR154* (UCSB), *Pollard s.n.* 8 OCT 1964, 2 DEC 1971 (PCF).

**Matricaria matricarioides* (Less.) Porter. Pineapple-weed. Annual herb; rare/scattered; road along beach, exposed channel margins and bed, seasonally wet soil and in river cobbles in flood plain area above Highway 101; Riverine Emergent Wetland, Ruderal Habitats; MAY-AUG; *Pang 43* (UCSB), *Pollard s.n.* 6 APR 1967 (PCF).

**Osteospermum fruticosum* (L.) Norl. Trailing African Daisy. Trailing perennial herb; rare/rare; dune swale wetland, disturbed areas, Emma Wood State Beach; Palustrine Scrub/Shrub Wetland, Ruderal Habitats; FEB- SEP; (ERT 1986-1989).

**Picris echioides* L. Bristly Ox Tongue. Annual herb; common/common; exposed channel margins and bed, alluvial (deltaic) terraces, abandoned temporary channels, dune swale wetland, scattered throughout study area, such as above

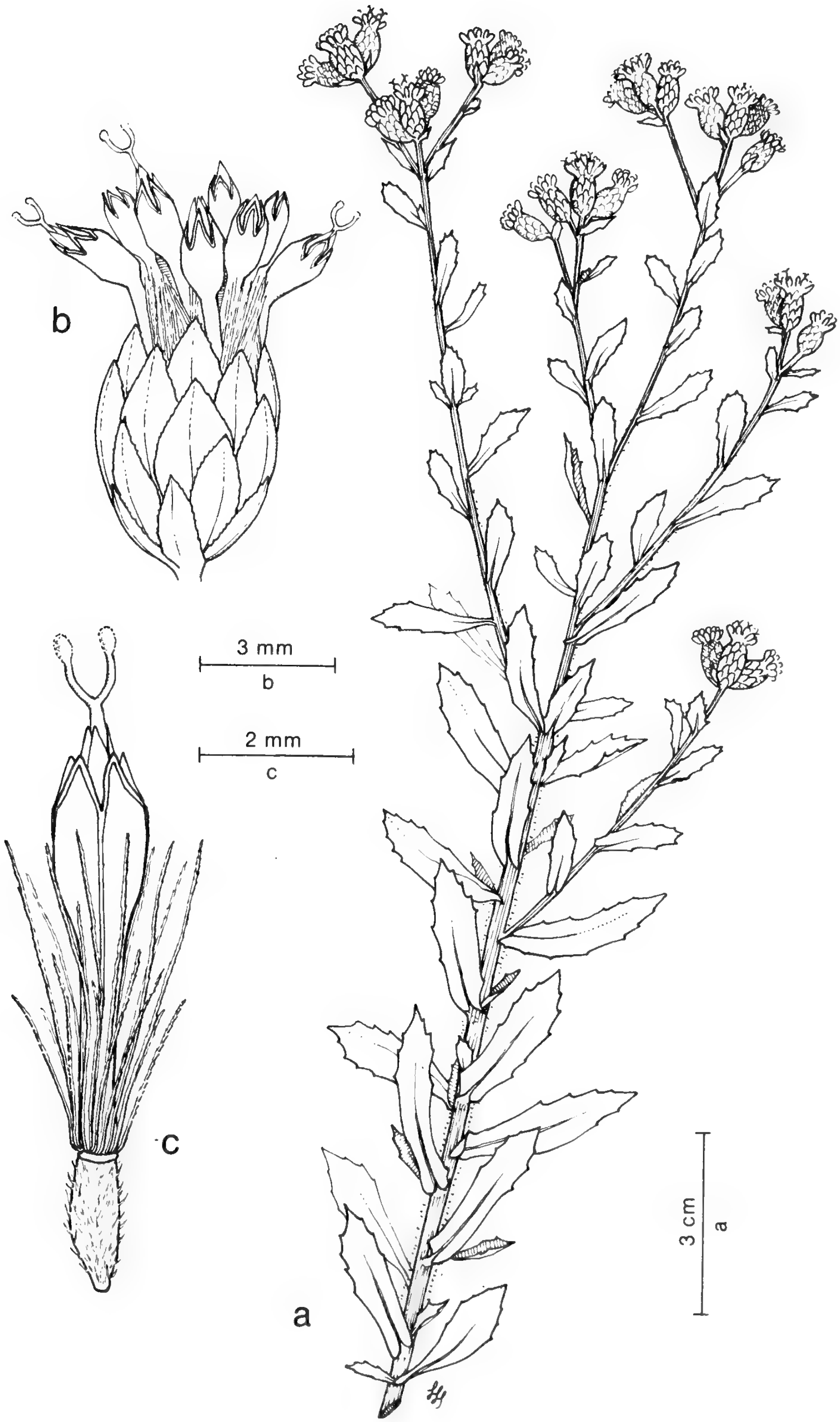

FIG. VIII-5. *Isocoma veneta* (HBK.) Greene var. *vernonioides* (Nutt.) Jeps. Coast Goldenbush. a. Stem, arrangement of capitula. b. Capitulum. c. Flower with bristles and developing achene.

Highway 101; Riverine Emergent Wetland, Palustrine Emergent Wetland, Palustrine Scrub/Shrub Wetland; JUN-DEC; *Rindlaub et al. VR49* (UCSB).

**Senecio mikanioides* Otto. German-ivy. Perennial vine; occasional/common; dune swale wetland, abandoned temporary channels, alluvial (deltaic) terrace, twining on shrubs and trees between railroad tracks and Main Street on west side of river, south of railroad and just east of second mouth, Emma Wood State Beach; Palustrine Scrub/Shrub Wetland, Palustrine Forested Wetland; DEC-MAR; *Magney VR-125-87, Magney et al. VR-146-87* (UCSB), *Pollard s.n.* 1 NOV 1960 (PCF).

**Senecio vulgaris* L. Common Groundsel. Annual herb; occasional/common; behind dunes, exposed riverbed and bars, sandy soil of flood plain above Highway 101; Palustrine Scrub/Shrub Wetland, Palustrine Emergent Wetland, Ruderal Habitat; most months; *Magney et al. VR108* (UCSB), *Pollard s.n.* 23 FEB 1946, 30 MAR 1967 (PCF).

**Silybum marianum* (L.) Gaertn. Milk Thistle. Annual herb; scattered/common; exposed riverbed and bars, alluvial (deltaic) terrace, disturbed areas; Palustrine Scrub/Shrub Wetland, Ruderal Habitats; MAY-JUL; *Pang 41* (UCSB).

Solidago confinis Gray. Marsh Goldenrod. Perennial herb; rare/(locally extirpated?); lowland near mouth, edge of willow thicket; JUN-DEC; *Pollard s.n.* 21 OCT 1945, 27 OCT 1945, 25 JAN 1948, 3 OCT 1948 (PCF).

**Sonchus asper* (L.) Hill. Prickly Sow-thistle. Annual herb; scattered/rare; dune swale wetland, exposed riverbed and bars, alluvial (deltaic) terrace, back dune swale area of Emma Wood State Beach, throughout flood plain area; Palustrine Scrub/Shrub Wetland, Ruderal Habitats; FEB-NOV; *Magney et al. VR125* (UCSB), *Pollard s.n.* 28 APR 1946, 2 JUN 1963 (PCF).

**Sonchus oleraceus* L. Sow-thistle. Annual herb; scattered/rare; exposed riverbed and bars, alluvial (deltaic) terrace, throughout flood plain area; Palustrine Scrub/Shrub Wetland; FEB-NOV; *Rindlaub et al. VR18* (UCSB).

**Tagetes patula* L. French Marigold. Annual herb; rare/uncommon; riverbed and flood plain near mouth; *Pollard s.n.* 27 OCT 1945, 21 SEP 1947 (PCF).

Venegasia carpesioides DC. Canyon Sunflower. Subshrub; uncommon/occasional; alluvial (deltaic) terrace, in shade under Main Street Bridge in flood plain area and under willows below Highway 101; Palustrine Scrub/Shrub Wetland, Palustrine Forested Wetland; FEB-SEP; *Rindlaub et al. VR73* (UCSB).

**Xanthium spinosum* L. Spiny Clotbur. Annual herb; rare/rare; exposed channel margins and bed, river cobbles in wash area above Highway 101; Riverine Emergent Wetland; JUL- OCT; (ERT 1986-1989), *Pollard s.n.* 27 OCT 1945 (PCF).

Xanthium strumarium L. var. *canadense* (Mill.) T.& G. Cocklebur. Annual herb; occasional/uncommon; exposed channel margins and bed, abandoned temporary channels, in ditch in flood plain area above Main Street; Riverine Emergent Wetland, Palustrine Emergent Wetland; JUL-OCT; *Magney et al. VR-128-87* (UCSB), *Pollard s.n.* 27 OCT 1945 (PCF).

BASELLACEAE

**Boussingaultea gracilis* Miens var. *pseudo-baselloides* Bailey. Madeira Vine. Twining perennial herb; rare/rare; river bank near mouth; *Pollard s.n.* 2 JUL 1946, 21 SEP 1946 (PCF).

BETULACEAE Birch Family

Alnus rhombifolia Nutt. White Alder. Tree; uncommon/occasional; river channel margin, at edge of flowing water of river between Highway 101 and Main Street, in cobbles; Palustrine Forested Wetland; JAN-APR; *Rindlaub et al. VR46* (UCSB).

BORAGINACEAE Borage Family

Amsinckia menziesii (Lehm.) Nels. & Macbr. Rigid Fiddleneck. Annual herb; rare/rare; exposed channel margins and bed, one plant observed in sands and river cobbles in flood plain above Highway 101; Riverine Emergent Wetland; FEB-JUN; *Rindlaub et al. VR120* (UCSB).

Amsinckia spectabilis F. & M. var. *spectabilis*. Spectacular Fiddleneck. Annual herb; rare/rare; sand dunes, beach sand and cobble at second mouth estuary, Emma Wood State Beach; Southern Coastal Dunes; FEB-JUN; *Magney et al. VR168* (UCSB), *Pollard s.n.* 23 FEB 1946, 25 FEB 1961 (PCF).

Cryptantha clevelandii Greene var. *florosa* Jtn. Cleveland's Large Cryptantha. Annual herb; occasional/(locally extirpated?); flats and road along beach, behind dunes, near river mouth; MAR-AUG; *Pollard s.n.* 23 FEB 1946, 25 FEB 1961, 6 APR 1967 (PCF).

Cryptantha muricata (H. & A.) Nels. & Macbr. var. *jonesii* (Gray) Jtn. Jones' Cryptantha. Annual herb; occasional/(locally extirpated?), riverbed near mouth; FEB-AUG; *Pollard s.n.* 6 OCT 1949 (PCF).

Heliotropium curassavicum L. var. *oculatum* (Heller) Jtn. Seaside Heliotrope. Perennial herb; scattered/common; beach, dune swale wetland, upper estuary margin, in moist soil at scattered locations throughout study area, such as in salt marsh area near second mouth, Emma Wood State Beach; Palustrine Scrub/Shrub Wetland, Estuarine Persistent Emergent Wetland, Ruderal Habitats; MAR-OCT; *Pang 27* (UCSB), *Pollard s.n.* 22 SEP 1945, 4 AUG 1970 (PCF).

BRASSICACEAE Mustard Family

**Brassica geniculata* (Desf.) J. Ball. Summer Mustard. Biennial or perennial herb; common/ abundant; levee, exposed riverbed and bars, alluvial (deltaic) terrace, back dune swale area of Emma Wood State Beach, in flood plain area above Main Street; Palustrine Scrub/Shrub Wetland, Ruderal Habitats; MAY-OCT; *Magney et al. VR-129-87* (UCSB), *Pollard s.n.* 17 NOV 1961 (PCF).

**Brassica nigra* (L.) Koch. Black Mustard. Annual herb; occasional/ common; exposed riverbed and bars, alluvial (deltaic) terrace, in flood plain area above Highway 101; Palustrine Scrub/Shrub Wetland, Ruderal Habitats; APR-JUL;

Rindlaub et al. VR6, Magney et al. VR129 (UCSB), *Pollard s.n.* 25 MAY 1947 (PCF).

**Brassica oleracea* L. Cabbage. Biennial or perennial herb; rare/rare; waste ground near river mouth; Ruderal Habitats; *Pollard s.n.* 23 MAR 1947, 25 FEB 1961 (PCF).

**Brassica rapa* L. ssp. *sylvestris* (L.) Janchen [*B. campestris* L.]. Field Mustard. Annual herb; rare/common; SPRR, exposed riverbed and bars, alluvial (deltaic) terrace, in flood plain area above Highway 101, Emma Wood State Beach; Palustrine Scrub/Shrub Wetland, Ruderal Habitats; JAN-MAY; *Magney et al. VR134* (UCSB), *Pollard s.n.* 10 JUN 1972 (PCF).

Cakile edentula (Biget) Hook. var. *californica* (Heller) Fern. California Sea-rocket. Annual herb; rare/(locally extirpated?); beach, river mouth, salt marsh; Southern Coastal Dunes; Estuarine Emergent Wetland; MAY-AUG; *Pollard s.n.* 13 OCT 1945; 1 AUG 1948 (PCF), 1 JUN 1946, 6 JUL 1962 (PCF, SBBG).

**Cakile maritima* Scop. Sea Rocket. Annual herb; common/common; dunes, margin of pond, river mouth, cobble beach berm and active sand beach, in exposed dune area, Emma Wood State Beach; Southern Coastal Dunes; JUN-NOV; *Magney VR-126-87* (UCSB), *Pollard s.n.* 1 AUG 1958, 27 NOV 1968 (PCF, SBBG).

**Capsella bursa-pastoris* (L.) Medic. Shepherd's Purse. Annual herb; rare/rare; behind dunes, alluvial (deltaic) terrace, under willows below Highway 101; Palustrine Forested Wetland, Palustrine Emergent Wetland, Ruderal Habitats; FEB-NOV; *Magney et al. VR126* (UCSB), *Pollard s.n.* 23 FEB 1946 (PCF).

Cardamine oligosperma Nutt. Few-seeded Bittercress. Annual herb; rare/rare; alluvial (deltaic) terrace, in sandy soils; Palustrine Scrub/Shrub Wetland, Palustrine Forested Wetland; FEB-MAY; *Magney et al. VR163* (UCSB).

**Cardaria draba* (L.) Desv. var. *draba*. Hoary Cress. Perennial herb; uncommon/occasional; dune swale wetland and pedestrian railroad undercrossing, Emma Wood State Beach; Ruderal Habitats, Palustrine Emergent Wetland, Palustrine Scrub/Shrub Wetland; MAR-JUN; *Magney et al. VR135, Pang 24* (UCSB), *Pollard s.n.* 14 APR 1946, 21 APR 1966 (PCF), 6 JUL 1962 (PCF, SBBG).

Descurainia pinnata (Walt.) Britton ssp. *menziesii* (DC.) Detl. Tansy Mustard. Annual herb; uncommon/ scattered; exposed riverbed and bars, alluvial (deltaic) terrace, in flood plain area above Highway 101; Ruderal Habitats, Palustrine Scrub/Shrub Wetland; MAR-JUN; *Rindlaub et al. VR53* (UCSB).

Lepidium lasiocarpum Nutt. Sand Peppergrass. Annual herb; uncommon/ scattered; sandy flats, beach, road along beach; FEB-JUN; (ERT 1986-1989), *Pollard s.n.* 14 APR 1947, 7 APR 1962 (PCF, SBBG), 2 MAR 1947, 25 FEB 1961, 30 MAR 1967 (PCF).

Lepidium nitidum Nutt. Shining Peppergrass. Annual; occasional/(locally extirpated?); behind beach dunes; FEB-APR; *Pollard s.n.* 23 FEB 1946 (PCF).

**Lobularia maritima* (L.) Desv. Sweet-alyssum. Perennial herb; rare/rare; beach, alluvial (deltaic) terrace, under willows below Highway 101 on east side of river; Ruderal Habitats, Palustrine Forested Wetland; FEB-OCT; *Magney et al. VR124*,

VR155 (UCSB), *Pollard s.n.* 1 FEB 1947, 24 FEB 1970, 10 NOV 1971 (PCF).

**Raphanus raphanistrum* L. Jointed Charlock. Annual or biennial herb; rare/uncommon; border of salt marsh W. of river; *Pollard s.n.* 25 MAY 1967 (SBBG).

**Raphanus sativus* L. Wild Radish. Annual herb; uncommon/uncommon; dune swale wetland, exposed riverbed and bars, alluvial (deltaic) terrace, in flood plain area in previously disturbed habitat above Main Street; Ruderal Habitats, Palustrine Scrub/Shrub Wetland; FEB-JUL; *Pang 21* (UCSB).

**Rorippa nasturtium-aquaticum* (L.) Schinz & Thell. [*Nasturtium officinale* L.]. Water-cress. Perennial aquatic herb; uncommon/scattered; channel margins and bed, in river in vicinity of Main Street Bridge; Riverine Emergent Wetland; MAR-NOV; *Rindlaub et al. VR26*, *VR80*, *Magney et al. VR-133-87* (UCSB), *Arbaugh 16* (OBI).

CACTACEAE

Opuntia littoralis (Engelm.) Cockerell. var. *littoralis*. Coastal Prickly-pear. Succulent-stemmed shrubs; rare/rare; near beach at river mouth; bluffs W. of river; MAY-JUN; *Pollard s.n.* 27 OCT 1945 (PCF).

CAPRIFOLIACEAE Honeysuckle Family

Sambucus mexicana Presl. Blue Elderberry. Shrub/small tree; occasional/ scattered; alluvial (deltaic) terrace, in flood plain area above Highway 101; Palustrine Scrub/Shrub Wetland, Palustrine Forested Wetland; MAR-SEP; *Rindlaub et al. VR15*, *VR17* (UCSB), *Pollard s.n.* 14 AUG 1967 (PCF).

CARYOPHYLLACEAE Pink Family

**Silene gallica* L. Windmill Pink. Annual herb; uncommon/occasional; alluvial (deltaic) terraces, in flood plain area above Highway 101; Palustrine Scrub/Shrub Wetland, Ruderal Habitats; FEB-JUN; *Rindlaub et al. VR41* (UCSB).

**Spergula arvensis* L. Corn Spurrey. Annual herb; uncommon/occasional; exposed riverbed and bars, above Highway 101; Palustrine Scrub/Shrub Wetland, Ruderal Habitats; FEB-NOV; (ERT 1986-1989), *Pollard s.n.* 21 APR 1966 (PCF).

**Spergularia bocconii* (Scheele) Foucaud. Boccone's Sand Spurrey. Annual; uncommon/scattered; road along beach W. of estuary; Ruderal Habitats; *Pollard s.n.* 6 APR 1967 (PCF).

Spergularia macrotheca (Hornem.) Heynh. var. *macrotheca* Large-flowered Sand Spurrey. Perennial herbs; rare/ scattered; beach W. of river; Southern Coastal Dunes, Estuarine Emergent Wetland; MAR-JUN; (ERT 1986-1989), *Pollard s.n.* 7 APR 1962 (PCF, SBBG).

Spergularia marina (L.) Griseb. Salt Marsh Sand Spurrey. Annual herb; common/common; exposed channel margins and bed, margins of estuary, along river bank above Highway 101, exposed flats and slopes, Seaside Wilderness Park; Riverine Emergent Wetland, Estuarine Nonpersistent Emergent Wetland; MAR-SEP; *Rindlaub et al. VR35*, *Magney & Ferren VR-132-86*, *Magney et al. VR150* (UCSB), *Pollard s.n.* 22 SEP 1945, 13 OCT 1945 (PCF), 21 APR 1966 (SBBG).

**Stellaria media* (L.) Vill. Common Chickweed. Annual herb; rare/occasional; riverbed, alluvial (deltaic) terrace, Palustrine Scrub/Shrub Wetland, Riverine Emergent Wetland, Ruderal Habitats; FEB-SEP; *Magney et al. VR123* (UCSB), *Pollard s.n.* 6 OCT 1945 (PCF).

CHENOPODIACEAE Goosefoot Family

Atriplex californica Moq. in DC. California Saltbush. Perennial herb; uncommon/scattered; dunes, flat bordering beach, cobbly beach and dune swale wetland, Emma Wood State Beach, Seaside Wilderness Park; Palustrine Emergent Wetland, Palustrine Scrub/Shrub Wetland, Southern Coastal Dunes; APR-NOV; *Rindlaub et al. VR82* (UCSB), *Pollard s.n.* 13 OCT 1945, 17 NOV 1960, 25 MAY 1967, 20 JUL 1970 (SBBG).

Atriplex coulteri (Moq.) D. Dietr. Coulter's Saltbush. Perennial herb; rare/(locally extirpated?); beach, river mouth, bluffs W. of river; MAR-SEP; *Pollard s.n.* 13 OCT 1945 (PCF).

Atriplex lentiformis (Torr.) Wats. ssp. *breweri* (Wats.) Hall & Clem. Brewer's Saltbush (Fig. VIII-6). Shrub; common/ scattered; margins of salt marsh vegetation, cobbly beach and dune swale wetland, alluvial (deltaic) terrace, abandoned temporary channels, along railroad tracks and in flood plain area above Main Street, Emma Wood State Beach; Estuarine Scrub/Shrub Wetland, Palustrine Scrub/Shrub Wetland, Ruderal Habitats; AUG-OCT; *Magney et al. VR-130-87* (UCSB), *Pollard s.n.* 23 NOV 1947, 18 SEP 1955 (PCF), 22 FEB 1945, 2 DEC 1971, (SBBG).

Atriplex lentiformis (Torr.) Wats. ssp. *breweri* (Wats.) Hall & Clem. X *A. leucophylla* (Moq.) D. Dietr. (?). Perennial hybrid herb; rare/rare; beach W. of river mouth; *Pollard s.n.* 10 NOV 1946 (PCF, SBBG), 13 OCT 1945, 23 NOV 1947, 25 JAN 1948, 7 FEB 1948 (PCF).

Atriplex leucophylla (Moq.) D. Dietr. Whiteleaf Saltbush. Prostrate perennial herb; uncommon/uncommon; dunes, cobble beach berm; Southern Coastal Dunes; APR-OCT; *Magney et al. VR117* (UCSB), *Pollard s.n.* 29 SEP 1945, 10 NOV 1946, 17 NOV 1960 (SBBG), 9 DEC 1961 (PCF).

Atriplex leucophylla (Moq.) D. Dietr. X *A. watsonii* A. Nels. (?). Perennial hybrid herb; rare/rare; beach, river mouth; *Pollard s.n.* 13 OCT 1945 (PCF, SBBG).

Atriplex patula L. ssp. *hastata* (L.) Hall & Clem. Spear-leaved Saltbush (Fig. VIII-7). Annual herb; common/scattered; exposed riverbed and bars, alluvial (deltaic) terrace, salt marsh margins of estuary, banks and bars, in flood plain area above Highway 101, exposed flats and slopes of estuary; Palustrine Scrub/Shrub Wetland, Estuarine Nonpersistent Emergent Wetland; JUN-NOV; *Rindlaub et al. VR82* (UCSB), *Pollard s.n.* 6 OCT 1945, 17 NOV 1961, 2 DEC 1971 (PCF).

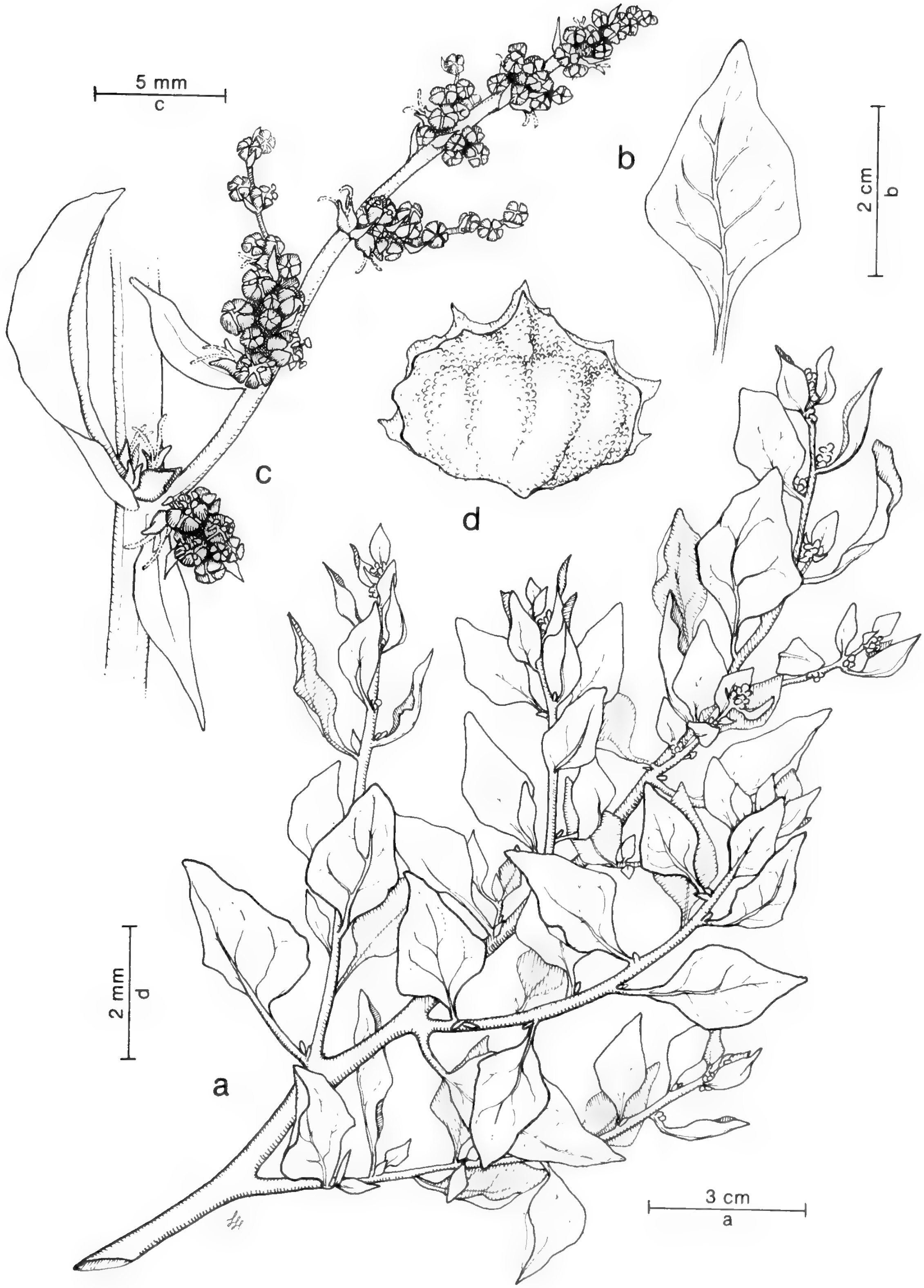

FIG. VIII-6. *Atriplex lentiformis* (Torr.) Wats. ssp. *breweri* (Wats.) Hall and Clem. Brewer's Saltbush. a. Branch. b. Leaf c. Branch of inflorescence. d. Bracts of pistillate flower.

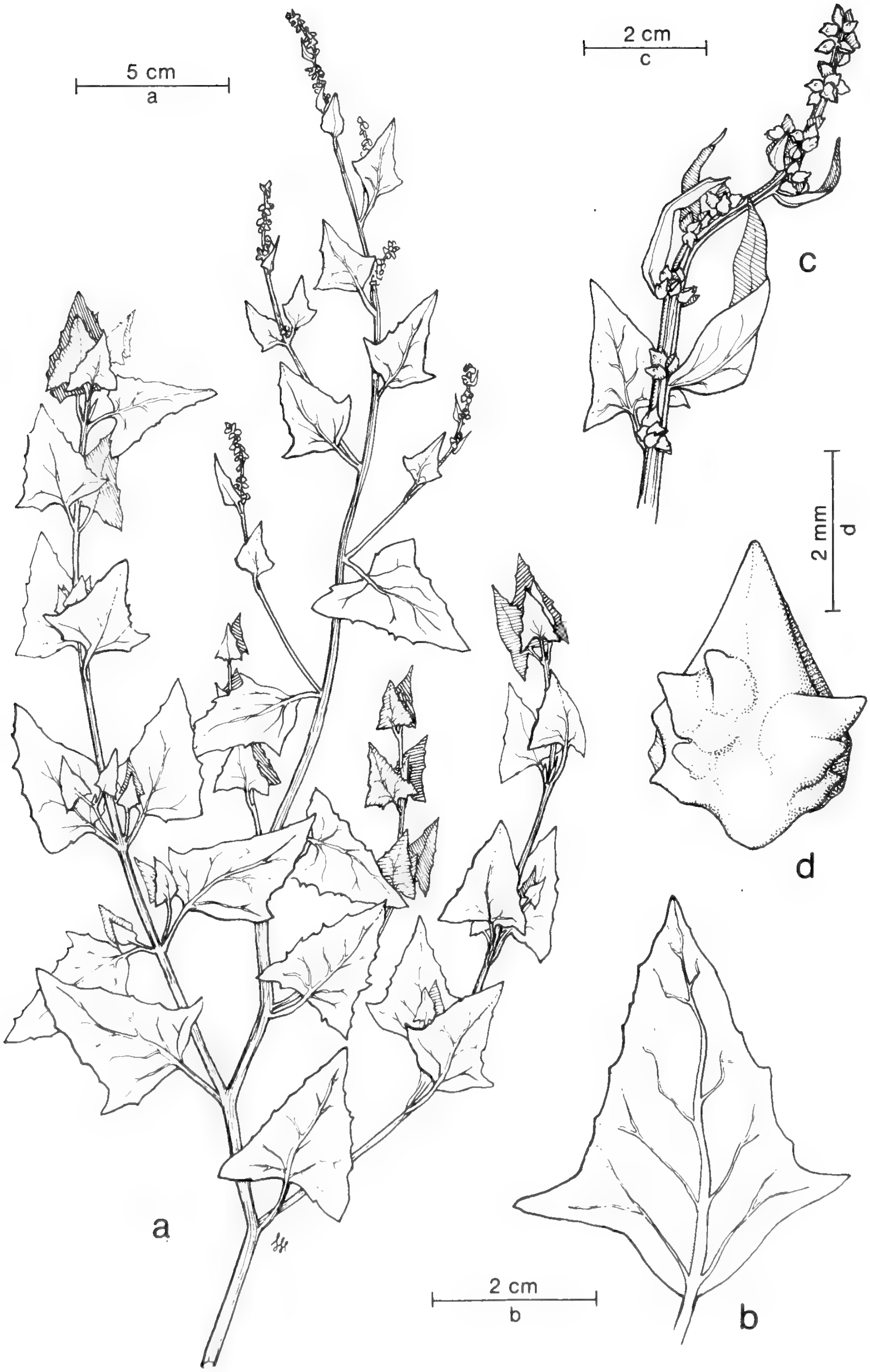

FIG. VIII-7. *Atriplex patula* L. ssp. *hastata* (L.) Hall and Clem. Spear-Leaved Saltbush. a. Upper stem. b. Leaf. c. Branch of inflorescence. d. Bracts of pistillate flower.

**Atriplex rosea* L. Redscale. Annual herb; scattered/scattered; SPPR, roadside, salt marsh margins of path in dune swale wetland and second mouth wetland; Palustrine and Estuarine Emergent Wetland, Ruderal Habitats; JUL-OCT; *Magney et al. VR169* (UCSB), *Pollard s.n.* 22 SEP 1945, 2 OCT 1959, 24 SEP 1962 (PCF).

**Atriplex semibaccata* R. Br. Australian Saltbush. Shrub; common/scattered; cobbly beach and dune swale wetland, exposed riverbed and bars, levee, alluvial (deltaic) terrace, along railroad tracks, in flood plain area above Main Street, Emma Wood State Beach; Ruderal Habitats, Palustrine Scrub/Shrub Wetland; APR-DEC; *Magney et al. VR137* (UCSB), *Pollard s.n.* 29 SEP 1945 (PCF).

Atriplex serenana A. Nels. Sereno Watson's Saltbush, Bract Saltbush. Annual herb; rare/rare; beach near river mouth, salt marsh, disturbed soil at Group Camp; Ruderal Habitats; JUN-OCT; *Ferren & Capelli VR181* (UCSB), *Pollard s.n.* 29 SEP 1945, 14 AUG 1962 (PCF).

Atriplex serenana A. Nels. X *A. argentea* Nutt. ssp. *expansa* (Wats.) Hall & Clem. (?). Annual hybrid herb; rare/rare; roadside, Emma Wood State Beach; *Pollard s.n.* 10 JUL 1972 (PCF).

**Bassia hyssopifolia* (Pall.) Kuntze. Fivehook, Smotherweed. Annual herb; common/scattered; margins of estuary, exposed riverbed and bars, fill material, on bank of levee, east side of estuary below railroad and west side, disturbed areas of flood plain area above Highway 101; Estuarine Emergent Wetland, Palustrine Emergent Wetland, Ruderal Habitats; JUL-OCT; *Magney et al. VR133*, *Magney & Ferren VR-128-86*, *VR-127-86* (UCSB), *Pollard s.n.* 29 SEP 1945 (PCF).

**Beta-vulgaris* L. Garden Beet. Perennial herb; uncommon/scattered; river mouth, low ground levee; Ruderal Habitats; *Pollard s.n.* 20 OCT 1945, 7 DEC 1946 (PCF).

**Chenopodium ambrosioides* L. Mexican-tea. Perennial herb; uncommon/ occasional; waste ground near mouth, exposed channel margins and bed, in cobbles along river bank between Highway 101 and Main Street; Riverine Emergent Wetland, Ruderal Habitats; JUN-OCT; *Magney et al. VR-136-87* (UCSB), *Pollard s.n.* 29 SEP 1945 (PCF), 9 DEC 1961, 2 DEC 1971 (SBBG).

Chenopodium berlandieri Moq. Berlander's Goosefoot. Annual herb; rare/rare; edge of salt marsh, flat behind dunes, exposed channel margins and bed, vicinity of Main Street Bridge, disturbed area, Seaside Wilderness Park; Riverine Emergent Wetland, Palustrine Emergent Wetland, Ruderal Habitats; JUN-NOV; *Magney et al. VR167*, *Ferren s.n.* (UCSB), *Pollard s.n.* 2 JUL 1966 (PCF).

Chenopodium californicum (Wats.) Wats. Soap Plant. Perennial herb; uncommon/scattered; road along beach W. of estuary; MAR-MAY;(ERT 1986-1989), *Pollard s.n.* 6 APR 1967 (SBBG).

Chenopodium macrospermum Hook. f. var. *farinosum* (Wats.) J. T. Howell [*C. f.* (S. Wats.) Standley]. Coast Goosefoot. Annual herb; common/common; margins of estuary, salt marsh, banks and bars, Emma Wood State Beach, Seaside Wilderness Park; Estuarine Nonpersistent Emergent Wetland; JUL-OCT; *Magney & Ferren VR-137-86*, (UCSB), *Pollard s.n.* 20 OCT 1945, 17 NOV 1960, 8 OCT 1964, 4 NOV 1971 (SBBG).

**Chenopodium missouriense* Aellen. Missouri Goosefoot. Annual; rare/rare; edge of salt marsh W. of estuary; *Pollard s.n.* 9 AUG 1962 (SBBG).

**Chenopodium murale* L. Nettle-leaved Goosefoot. Annual herb; uncommon/occasional; dune swale wetland, exposed riverbed and bars, alluvial (deltaic) terrace, in flood plain area above Highway 101; Riverine Emergent Wetland, Palustrine Scrub/Shrub Wetland, Ruderal Habitats; JAN-DEC; *Rindlaub et al. VR57* (UCSB), *Pollard s.n.* 29 SEP 1945, 2 DEC 1971, 10 JUN 1972 (SBBG).

**Kochia scoparia* (L.) Schrad. Summer-cypress. Annual herb; rare/rare; exposed channel margins and bed, vicinity of Main Street Bridge; Riverine Emergent Wetland; AUG-OCT; *Ferren 2123* (UCSB).

Salicornia virginica L. Pickleweed (Fig. VIII-8). Succulent perennial herb; scattered/abundant; dune swale wetland, river mouth swale wetland, estuary margin, margins of salt marsh vegetation, in salt marsh area associated with second mouth above and below railroad tracks, Emma Wood State Beach, Seaside Wilderness Park; Palustrine Emergent Wetland, Estuarine Persistent Emergent Wetland, Estuarine Scrub/Shrub Wetland; AUG-NOV; *Magney & Ferren VR-131-86 & VR-95-87*, *Magney et al. VR-160-87* (UCSB), *Pollard s.n.* 29 SEP 1945, 17 NOV 1961, 4 NOV 1971 (PCF).

**Salsola australis* R. Br. [*S. iberica* Sennen & Pau., *S. kali* L.]. Russian Thistle. Annual herb; scattered/common; alluvial (deltaic) terrace, along levee along east side of flood plain area above Highway 101; Ruderal Habitats, Palustrine Scrub/Shrub Wetland; JUL-OCT; (ERT 1986-1989), *Pollard s.n.* 20 OCT 1945, 1 DEC 1969, 10 NOV 1971 (PCF).

Suaeda taxifolia (Standley) Standley [*S. californica* Wats. var. *pubescens* Jeps.]. Woolly Sea-blite. Shrub or suffrutescent perennial herb; rare/rare; dune swale wetland; Palustrine Scrub/Shrub Wetland; JUN-NOV; *Ferren 3203* (UCSB), *Pollard s.n.* 17 NOV 1961 (RSA), 20 NOV 1945 (SBBG), 29 SEP 1945, 10 FEB 1952 (PCF).

CONVOLVULACEAE Morning-glory Family

Calystegia macrostegia (Greene) Brummitt ssp. *cyclostegia* (House) Brummitt. Purple-bracted Morning-glory. Perennial vine; uncommon/occasional; dune swale wetland, alluvial (deltaic) terrace, on shrubs in back dune swale and flood plain area above Highway 101; Palustrine Scrub/Shrub and Forested Wetland, Ruderal Habitats; MAR-AUG; *Pang 39* (UCSB), *Pollard s.n.* 30 MAR 1967, 29 FEB 1968 (PCF).

Calystegia soldanella (L.) R. Br. Beach Morning-glory. Perennial vine; common/occasional; sand dunes, Emma Wood State Beach; Southern Coastal Dunes; APR-MAY; *Magney et al. VR-153-87* (UCSB), *Pollard s.n.* 20 OCT 1945, 7 APR 1946 (PCF).

Cuscuta ceanothi Behr. Dodder. Annual parasitic herb; occasional/scattered; flood plain, on *Atriplex lentiformis*, *Baccharis glutinosa*; Palustrine Scrub/Shrub Wetland; APR-NOV; (ERT 1986-1989), *Pollard s.n.* 2 DEC 1971 (PCF).

Cuscuta salina Engelm. var. *major* Yunck. Salt Marsh Dodder. Annual parasitic

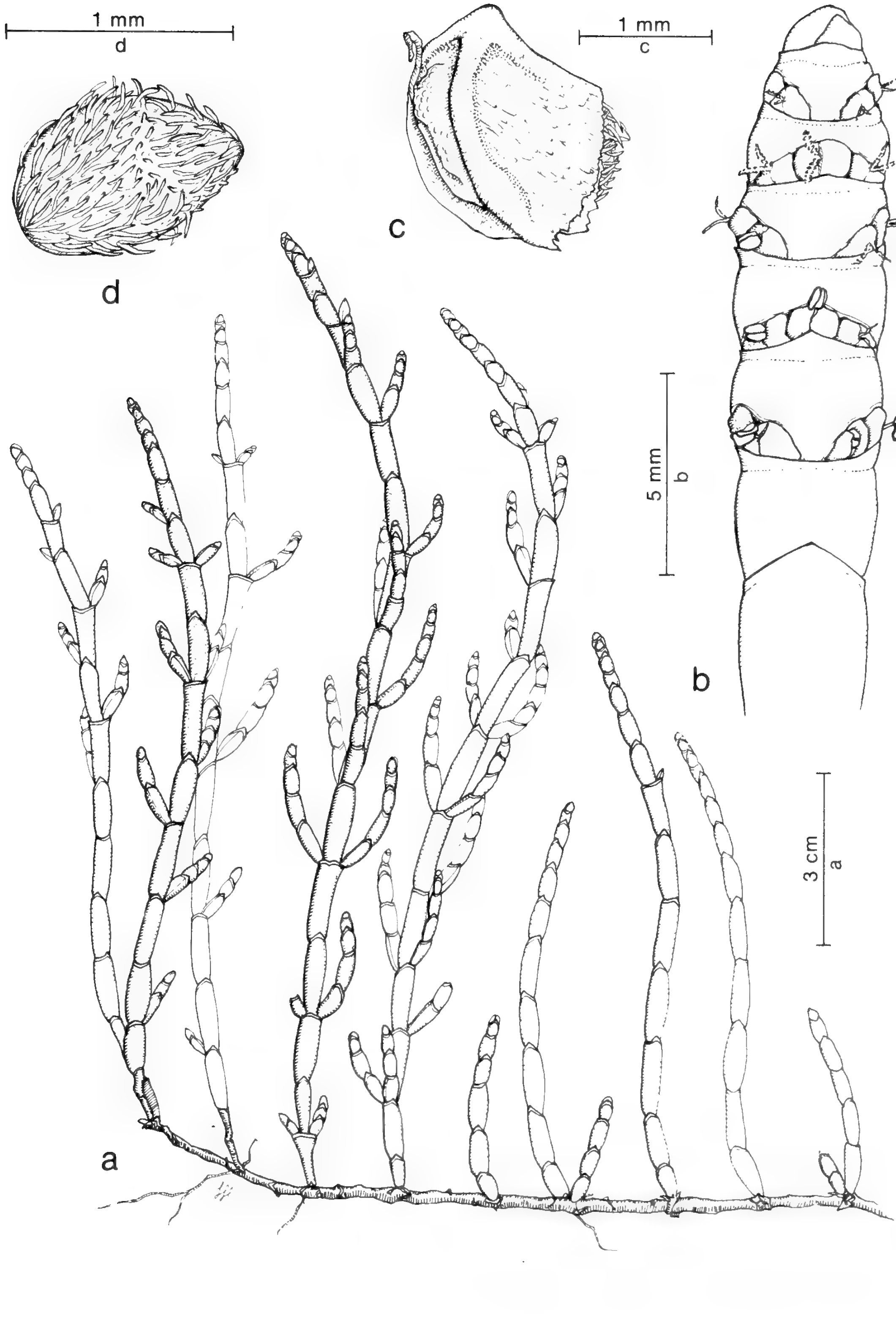

FIG. VIII-8. *Salicornia virginica* L. Pickleweed.
a. Habit. b. Inflorescence. c. Flower with ripening ovary. d. Seed

herb; uncommon/common; estuary margins, parasitic on *Salicornia virginica* and *Frankenia salina* in vicinity of second mouth, Emma Wood State Beach; Estuarine Persistent Emergent Wetland; MAR-OCT; (ERT 1986-1989), *Pollard s.n.* 13 OCT 1945 (PCF). *Cuscuta californica* H. & A. has been informally reported by the Channel Coast Natural History Association, on dune plants at the Ventura River Group Camp.

CRASSULACEAE Stonecrop Family

Crassula connata (Ruiz & Pav.) Berger var. *erectoides* Bywater & Wilkens [*C. erecta* (H. & A.) Berger]. Sand Pygmy-stonecrop. Annual herb; rare/abundant; exposed riverbed and bars, dune swale sand flats, alluvial (deltaic) terrace, in sandy soil above Highway 101; Palustrine Scrub/Shrub Wetland, Southern Coastal Dunes, Ruderal Habitats; MAR-MAY; *Magney et al. VR115* (UCSB).

Dudleya caespitosa (Haw.) Britt. & Rose. Sand Lettuce. Succulent perennial; rare/(locally extirpated?); behind beach dunes, sandy flat between beach and railroad, bluffs W. of river; JUN-AUG; *Pollard s.n.* 19 MAR 1946, 6 JUL 1962 (PCF, SBBG).

CUCURBITACEAE Gourd Family

**Citrullus lanatus* (Thunb.) Mansf. Watermelon. Annual trailing herb; rare/rare; edge of dune willow thicket, river mouth; *Pollard s.n.* 1 AUG 1958 (PCF).

**Cucurbita pepo* L. Field Pumpkin. Annual trailing herb; rare/rare; edge of willow thicket and salt marsh, SPRR; *Pollard s.n.* 6 JUN 1948, 6 JUL 1962 (PCF).

Marah fabaceus (Naud.) Greene var. *agrestis* (Greene) Stocking. Man Root. Perennial vine; occasional/occasional; alluvial (deltaic) terrace, in shade climbing on *Salix lasiolepis* west of river between railroad and Highway 101, Emma Wood State Beach; Palustrine Forested Wetland; FEB-APR; *Magney et al. VR-148-87* (UCSB).

EUPHORBIACEAE Spurge Family

**Euphorbia lathyris* L. Caper or Gopher Spurge. Annual or biennial herb; rare/rare; dune swale wetland, exposed riverbed and bars, alluvial (deltaic) terrace, back dune swale area of Emma Wood State Beach, shade of Main Street Bridge in flood plain area, Ruderal Habitats; Palustrine Scrub/Shrub Wetland; FEB-NOV; (ERT 1986-1989), *Pollard s.n.* 22 SEP 1945, 19 MAY 1946, 26 JUL 1963 (PCF).

**Euphorbia peplus* L. Petty Spurge. Annual herb; rare/rare; exposed riverbed and bars, in open area above Main Street in flood plain area; Palustrine Scrub/Shrub Wetland, Ruderal Habitats; FEB-AUG; *Rindlaub et al. VR14* (UCSB).

**Ricinus communis* L. Castor Bean. Shrub; common/abundant; exposed riverbed and bars, alluvial (deltaic) terrace, throughout study area, especially in open areas such as along trails/roads, Emma Wood State Beach; Palustrine Scrub/Shrub Wetland, Palustrine Forested Wetland, Ruderal Habitats; FEB-NOV; *Pang 38*, *Rindlaub et al. VR61* (UCSB), *Pollard s.n.* 11 NOV 1971 (PCF).

Astragalus trichopodus (Nutt.) Gray ssp. *trichopodus*. Southern California Locoweed or Three-podded Milk-vetch. Perennial herb; rare/rare; exposed riverbed and bars, in flood plain area above Highway 101; Palustrine Scrub/Shrub Wetland, Ruderal Habitats; FEB-JUN; *Rindlaub et al. VR50*, *Magney et al. VR146* (UCSB).

Glycyrrhiza lepidota Pursh var. *glutinosa* (Nutt.) Wats. Wild Licorice. Perennial herb; rare/rare; lowland, river mouth; MAY-JUL; *Pollard s.n.* 23 JUN 1946 (PCF).

**Hoffmannseggia densiflora* Benth. ex Gray. Indian Rushpea. Perennial herb; rare/rare; river mouth, railroad; *Pollard s.n.* 13 OCT 1945, 21 APR 1946, 13 AUG 1949 (PCF).

Lotus salsuginosus Greene ssp. *salsuginosus*. Coastal Hosackia. Prostrate annual herb; rare/ rare; sand dunes, exposed riverbed and bars, flood plains; Southern Coastal Dunes, Riverine Emergent Wetland, Palustrine Scrub/Shrub Wetland; MAR-JUN; *Pollard s.n.* 21 April 1966 (CAS), *Rindlaub et al. VR51* (UCSB).

Lotus scoparius (Nutt. in T.& G.) Ottley ssp. *scoparius*. Deerweed. Perennial herb/subshrub; rare/rare; beach, alluvial (deltaic) terrace, in flood plain area above Highway 101; Palustrine Scrub/Shrub Wetland, Coastal Sage Scrub, Ruderal Habitats; MAR-AUG; *Pollard s.n.* 19 May 1946 (CAS), *Pollard s.n.* 19 MAY 1946 (SBBG), *Rindlaub et al. VR55* (UCSB).

Lupinus arboreus Sims. Coastal Bush Lupine. Shrub; rare/(locally extirpated?); beach at river mouth; Southern Coastal Dunes; MAR-SEP; *Pollard s.n.* 14 APR 1946, 19 MAY 1946 (PCF).

Lupinus succulentus Dougl. ex Koch. Succulent Lupine. Annual herb; scattered/ occasional; dune swale wetland, in back dune area of Emma Wood State Beach, exposed riverbed and bars, above Highway 101; Palustrine Emergent Wetland, Palustrine Scrub/Shrub Wetland; FEB-MAY; *Rindlaub et al. VR84* (UCSB).

**Medicago polymorpha* L. Bur-clover. Annual herb; common/scattered; exposed channel margins, riverbed, and bars, alluvial (deltaic) terrace, throughout flood plain area; Riverine Emergent Wetland, Palustrine Scrub/Shrub Wetland; MAR-JUN; *Magney et al. VR111*, *VR122* (UCSB).

**Medicago sativa* L. Alfalfa. Perennial herb; rare/rare; flood plain near river mouth; *Pollard s.n.* 21 SEP 1947 (PCF).

**Melilotus alba* Desr. White Sweetclover. Annual herb; common/scattered; exposed channel margins and bed, alluvial (deltaic) terrace, in flood plain area above Highway 101; Riverine Emergent Wetland, Palustrine Scrub/Shrub Wetland, Estuarine Emergent Wetland; MAY-SEP; *Rindlaub et al. VR10* (UCSB).

**Melilotus indica* (L.) All. Yellow Sweetclover. Annual herb; common/scattered; dune swale wetland, exposed riverbed and bars, alluvial (deltaic) terrace, in flood plain area above Highway 101; Riverine Emergent Wetland, Palustrine Scrub/Shrub Wetland; APR-OCT; *Rindlaub et al. VR9*, *Pang 25* (UCSB).

**Spartium junceum* L. Spanish Broom. Shrub; rare/rare; alluvial (deltaic) terrace, in flood plain area above Highway 101; Palustrine Scrub/Shrub Wetland; APR-JUN; *Rindlaub et al. VR60* (UCSB).

**Vicia benghalensis* L. Purple Vetch. Annual herb; occasional/scattered; flood plain; *Pollard s.n.* 1 JUN 1946, 24 FEB 1970 (PCF).

FRANKENIACEAE Frankenia Family

Frankenia salina Jtn. [*F. grandifolia* Cham. & Schlecht.]. Alkali Heath (Fig. VIII-9). Perennial herb; uncommon/ abundant; margins of estuary, east side of estuary from railroad to mouth of river, in saline soil in marshy area associated with second mouth and back dune swale area of Emma Wood State Beach; Estuarine Persistent Emergent Wetland, Palustrine Scrub/Shrub Wetland; JUN-OCT; *Magney et al. VR-134-86, VR- 159-87* (UCSB), *Pollard s.n.* 20 JUL 1970 (PCF).

GERANIACEAE Geranium Family

**Erodium cicutarium* (L.) L'Her. Redstem Filaree. Annual herb; common/ common; exposed riverbed and bars, alluvial (deltaic) terrace, in flood plain area above Highway 101; Palustrine Scrub/Shrub Wetland, Ruderal Habitats; FEB-MAY; *Rindlaub et al. VR64, Pang 33* (UCSB).

**Pelargonium* X *hortorum* Bailey. Fish Geranium. Perennial herb; rare/rare; alluvial (deltaic) terrace, in shade of willows below Highway 101; Palustrine Forested Wetland; MAR- JUL; *Magney et al. VR130* (UCSB).

HYDROPHYLLACEAE Waterleaf Family

Eucrypta chrysanthemifolia (Benth.) Greene var. *chrysanthemifolia*. Common Eucrypta. Annual herb; rare/rare; flood plain, Emma Wood State Beach; Palustrine Forested Wetland; *Magney et al. VR164* (UCSB). Another Hydrophyll, *Pholistoma auritum* (Lindl.) Lilja [Fiesta Flower], also has been reported from Palustrine Forested Wetland.

Phacelia ramosissima Dougl. ex Lehm. var. *austrolitoralis* Munz. Beach Phacelia. Shrub, perennial herb or shrub; uncommon/occasional; sand dunes, Emma Wood State Beach; Southern Coastal Dunes; MAY-AUG, (ERT 1986-1989), *Pollard s.n.* 2 JUN 1963, 12 JUL 1966 (PCF).

JUGLANDACEAE Walnut Family

Juglans californica Wats. Southern California Black Walnut. Tree; uncommon/ rare (possibly hybrids); flood plain, along border of flood plain area; Palustrine Forested Wetland; APR-MAY; *Magney et al. VR127, Ferren s.n.* (UCSB). All trees observed may be sterile hybrids resulting from crosses with *J. regia* L. [English walnut].

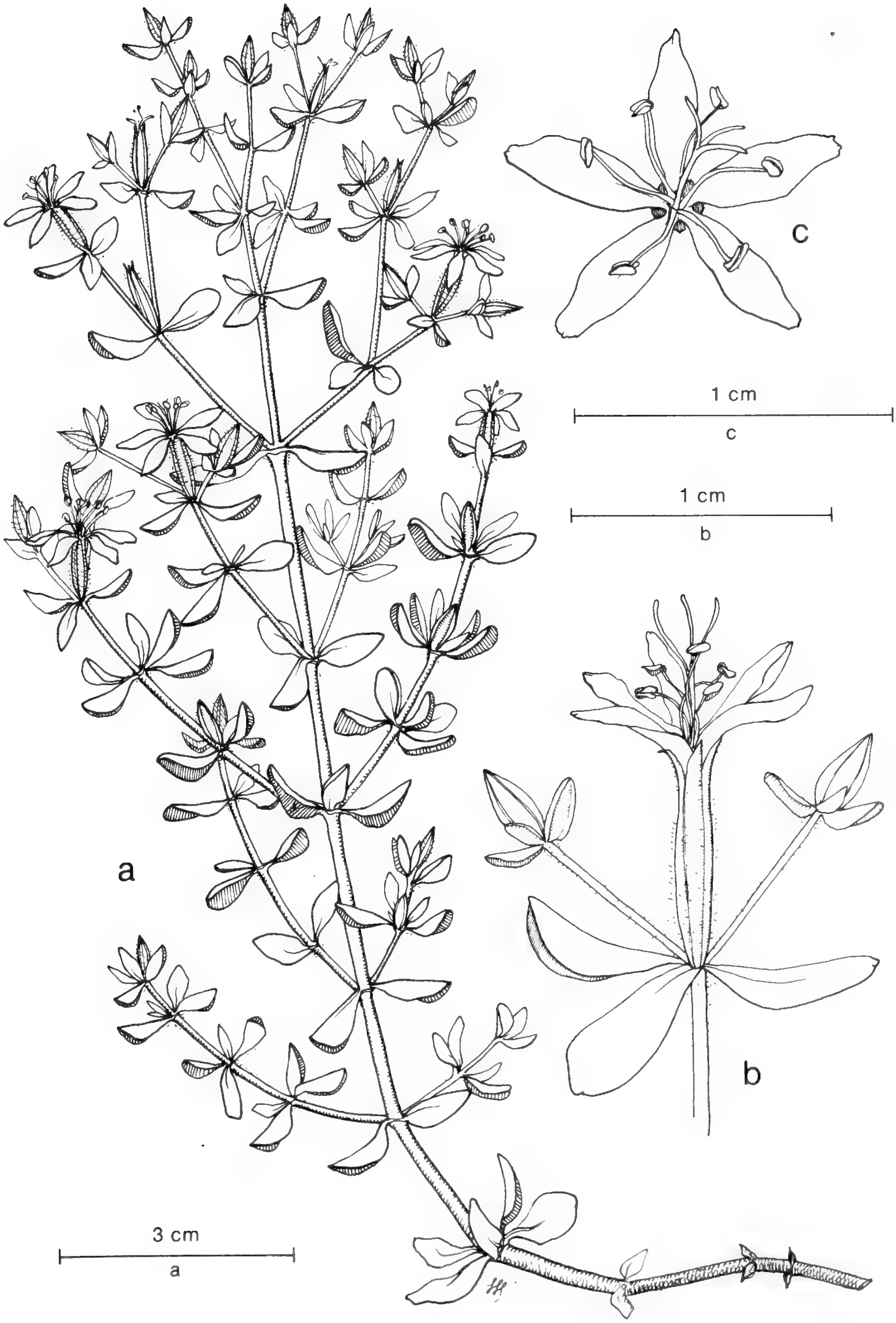

FIG. VIII-9. *Frankenia salina* Jtn. Alkali Heath.
a. Habit. b. Portion of inflorescence. c. Flower.

LAMIACEAE Mint Family

**Marrubium vulgare* L. White Horehound. Perennial herb; uncommon/occasional; in flood plain area above Main Street; Palustrine Scrub/Shrub Wetland, Ruderal Habitats; MAR-AUG; *Rindlaub et al. VR3* (UCSB).

Salvia leucophylla Greene. Purple Sage. Shrub; rare/rare; in flood plain area above Highway 101; Palustrine Scrub/Shrub Wetland, Coastal Sage Scrub; MAY-JUL; *Rindlaub et al. VR52* (UCSB).

Salvia mellifera Greene. Black Sage. Shrub; rare/rare; alluvial (deltaic) terrace, in flood plain area above Highway 101; Palustrine Scrub/Shrub Wetland, Coastal Sage Scrub; APR-JUL; *Magney et al. VR110* (UCSB).

Stachys bullata Benth. California Hedge Nettle. Perennial herb; uncommon/rare; behind dunes, in flood plain area above Highway 101; Palustrine Forested Wetland, Palustrine Emergent Wetland; APR-SEP; *Rindlaub et al. VR44*, *Magney et al. VR165* (UCSB), *Pollard s.n.* 14 APR 1946, 27 MAY 1967 (PCF).

LINACEAE

**Linum usitatissimum* L. Common Flax. Annual herb; rare/rare; railroad W. of river mouth; Ruderal Habitats; *Pollard s.n.* 29 SEP 1945, 23 FEB 1946, 2 MAR 1947 (PCF).

LOASACEAE Stick-leaf Family

Mentzelia sp. Blazing Star. Annual herb; rare/rare; alluvial (deltaic) terrace, exposed channel margins and bed, in flood plain area above Highway 101; Palustrine Scrub/Shrub Wetland, Riverine Emergent Wetland; JUN-OCT, (ERT 1986-1989).

LYTHRACEAE Loosestrife Family

Lythrum californicum T. & G. California Loosestrife. Perennial herb; occasional/rare; marsh at river mouth, estuary margins, salt marsh at second mouth; Estuarine Persistent Wetland; APR-OCT; (ERT 1986-1989), *Pollard s.n.* 10 NOV 1945 (SBBG).

MALVACEAE Mallow Family

**Lavatera cretica* L. Cretan Lavatera. Annual herb; occasional/scattered; railroad at river mouth; Ruderal Habitats; *Pollard s.n.* 21 APR 1946 (PCF).

Malacothamnus fasciculatus (Nutt.) Greene var. *nuttallii* (Abrams) Kearn. Nuttall's Chaparral Mallow. Shrub; uncommon/uncommon; alluvial (deltaic) terrace, in forested area between railroad and Highway 101 on west side of river, Emma Wood State Beach; Palustrine Forested Wetland, Palustrine Scrub/Shrub Wetland; APR-JUL; (ERT 1986-1989), *Pollard s.n.* 10 NOV 1971 (PCF).

**Malva parviflora* L. Cheeseweed. Annual herb; common/common; disturbed area and exposed riverbed and bars, in flood plain area above Main Street; Palustrine Scrub/Shrub Wetland, Ruderal Habitats; FEB-NOV; *Rindlaub et al. VR12* (UCSB).

MYOPORACEAE Myoporum Family

**Myoporum laetum* Forst. f. Myoporum. Shrub/small tree; occasional/scattered; flood plain, dune swale wetland, scattered throughout study area, Seaside Wilderness Park, Emma Wood State Beach; Palustrine Scrub/Shrub Wetland, Palustrine Forested Wetland, Ruderal Habitats; *Magney et al. VR141* (UCSB).

MYRTACEAE Myrtle Family

**Eucalyptus camaldulensis* Dehnhardt. River Red Gum. Tree; rare/rare; in flood plain area between Highway 101 and Main Street; Palustrine Forested Wetland; JAN-MAY; *Magney et al. VR156* (UCSB).

NYCTAGINACEAE Four-O'Clock Family

Abronia maritima Nutt. ex Wats. Sticky Sand-verbena. Perennial herb; rare/rare; beach, dunes W. of river mouth, dunes in Emma Wood State Beach; Southern Coastal Dunes; FEB-OCT; *Magney et al. VR-154-87* (UCSB), *Pollard s.n.* 22 SEP 1945, 20 OCT 1945 (PCF).

Abronia umbellata Lam. Beach Sand-verbena. Perennial herb; scattered/ occasional; beach, dunes W. of river mouth, dunes at Emma Wood State Beach; Southern Coastal Dunes; FEB-NOV; *Magney & Ferren VR-90-87* (UCSB); *Pollard s.n.* 29 SEP 1945, 27 NOV 1968, 4 AUG 1970 (PCF).

OLEACEAE Olive family

Fraxinus velutina Torr. Flowering Ash. Shrub/tree; rare/rare; in shade of willows below Highway 101, Hubbard Property; Palustrine Forested Wetland; APR-MAY; *Magney et al. VR131* (UCSB).

ONAGRACEAE Evening-primrose Family

Camissonia boothii (Dougl. in Hook.) ssp. *decorticans* (H. & A.) Raven. Evening-primrose. Annual herb; rare/rare; reported from study area by Pollard; MAR-JUN; *Pollard s.n.* 21 SEP 1947 (CAS).

Camissonia cheiranthifolia (Hornem. ex Spreng.) Raimann in Engl. & Prantl. ssp. *suffruticosa* (Wats.) Raven. Beach Evening Primrose (Fig. VIII-10). Perennial herb; common/common; sand dunes, Emma Wood State Beach; Southern Coastal Dunes; APR-AUG; *Magney & Ferren VR-91-87* (UCSB), *Pollard s.n.* 25 MAY 1967 (DS), *Pollard s.n.* 27 NOV 1968 (CAS), *Pollard s.n.* 22 SEP 1945, 14 APR 1946, 27 NOV 1968 (PCF).

Camissonia micrantha (Hornem. ex Spreng.) Raven. Small Primrose. Annual herb; occasional/(locally extirpated?); behind beach dunes near mouth, beach near mouth; MAR-MAY; *Pollard s.n.* 3 FEB 1946, 1 FEB 1947, 24 APR 1948 (PCF).

Epilobium canum (Greene) Raven ssp. *angustifolium* (Keck) Raven. [*Zauchneria californica* Presl] California Fuchsia. Perennial herb; uncommon/uncommon; river bank, shoreline of estuary, lowland near mouth; JUN-OCT; *Pollard s.n.* 21 OCT 1945, 20 SEP 1961, 13 OCT 1965 (PCF).

Epilobium ciliatum Raf. ssp. *ciliatum* [*E. adenocaulon* Hausskn. var. *holosericeum* (Trel.) Munz; *E. a.* var. *parishii* (Trel.) Munz]. Northern Willow-herb. Perennial herb; uncommon/occasional; channel margins and bed, on river bank at Main Street; Riverine Emergent Wetland; JUL-SEP; *Rindlaub et al. VR31* (UCSB).

**Ludwigia uruguayensis* (Camb.) Hara. Uruguay Water Primrose. Perennial aquatic herb; common/abundant; channel margins and bed, choking river from Main Street down to estuary boundary and occasionally along margins of estuary; Riverine Emergent Wetland; MAY-OCT; *Rindlaub et al. VR29, VR80, Magney & Ferren VR-68-87, Magney et al. VR-138-87* (UCSB); Smith (1976).

Oenothera hookeri T. & G. Evening Primrose. Biennial herb; occasional/(locally extirpated?); flat behind dunes, lowland near mouth; JUN-NOV; *Pollard s.n.* 21 OCT 1945, 12 JUL 1966 (PCF).

OXALIDACEAE Wood-sorrel Family

**Oxalis pes-caprae* L. Bermuda-buttercup. Perennial herb; scattered/occasional; dune swale wetland, in ruderal area in Hobo Jungle, Seaside Wilderness Park; Ruderal Habitats, Palustrine Emergent Wetland; NOV-MAR; *Magney et al. VR-149-87* (UCSB), *Pollard s.n.* 3 MAR 1946 (PCF).

PAPAVERACEAE

Dicentra chrysantha (H. & A.) Walp. Golden Ear-Drops. Perennial herb; rare/(locally extirpated?); under levee near estuary; APR-SEP; *Pollard s.n.* 4 JUN 1964 (PCF, SBBG).

**Papaver somniferum* L. Opium Poppy. Annual herb; rare/rare; highway at river mouth; Ruderal Habitats; SUMMER; *Pollard s.n.* 19 MAY 1946 (PCF, SBBG).

PLANTAGINACEAE Plantain Family

Plantago bigelovii Gray ssp. *californica* (Greene) Bassett. Bigelow's Plantain. Annual; rare/(locally extirpated?); dried mud flats on road between railroad and beach; JAN-APR; *Pollard s.n.* 30 MAR 1967 (PCF).

**Plantago lanceolata* L. English Plantain, Ribgrass. Perennial herb; scattered/uncommon; exposed channel margins, riverbed, and bars, alluvial (deltaic) terrace, in flood plain area above Highway 101; Riverine Emergent Wetland, Palustrine Scrub/Shrub Wetland; APR-AUG; *Rindlaub et al. VR56* (UCSB).

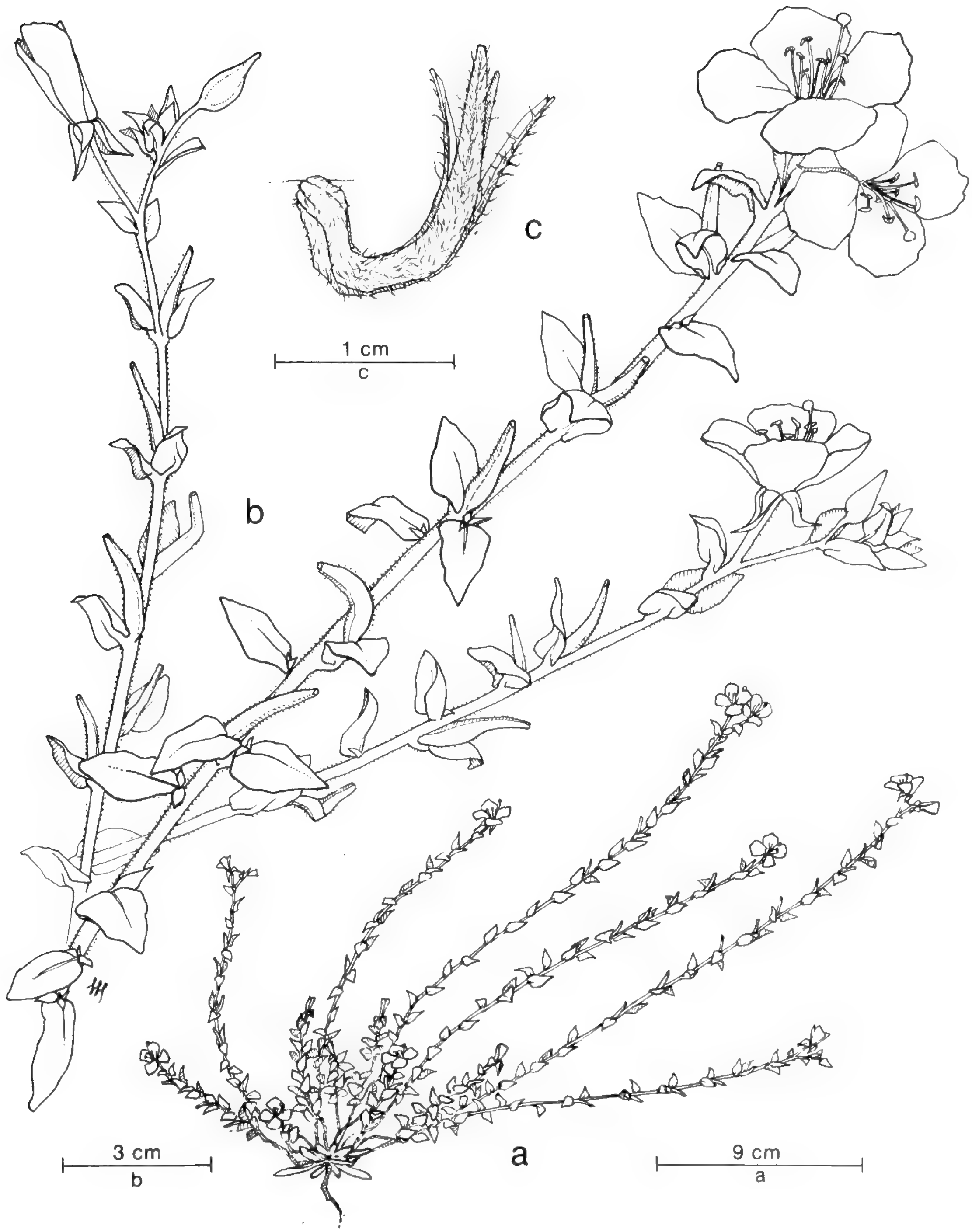

FIG. VIII-10. *Camissonia cheiranthifolia* (Hornem. ex Spreng.) Raimann in Engl. and Pranti ssp. *suffruticosa* (Wats.) Raven. Beach Primrose. a. Habit. b. Inflorescence. c. Capsule.

**Plantago major* L. Common Plantain. Perennial herb; rare/rare; saline flat and salt marsh, channel margins and bed, on river bank under Main Street Bridge; Estuarine Emergent Wetland, Riverine Emergent Wetland, Palustrine Emergent Wetland; APR-SEP: *Rindlaub et al. VR58, Magney & Ferren VR-71-87* (UCSB), *Pollard s.n.* 4 NOV 1971 (PCF).

PLATANACEAE Sycamore Family

Platanus racemosa Nutt. California Sycamore. Tree; rare/rare; alluvial (deltaic) terrace, at northeast corner of RV park and below Main Street; Palustrine Forested Wetland; FEB-APR; *Magney et al. VR148* (UCSB).

POLYGONACEAE Buckwheat Family

Eriogonum cinereum Benth. Ashyleaf Buckwheat. Shrub; occasional/scattered; railroad, bluffs, flood plain, beach near river mouth; Coastal Sage Scrub, Palustrine Scrub/Shrub Wetland, Southern Coastal Dunes, Coastal Bluff Scrub; MAY-DEC; (ERT 1986-1989), *Pollard s.n.* 22 SEP 1945, 1 DEC 1969, 20 JUN 1970 (PCF, SBBG), 10 NOV 1946 (PCF).

Eriogonum fasciculatum Benth. ssp. *fasciculatum*. California Buckwheat. Shrub; uncommon/ occasional; alluvial (deltaic) terrace, in cobbles of exposed riverbed, in area above Highway 101, and road banks; Palustrine Scrub/Shrub Wetland, Coastal Sage Scrub; MAR-OCT; *Magney et al. VR-142-87* (UCSB).

Eriogonum parvifolium Sm. in Rees. Seacliff Buckwheat. Shrub; uncommon/ occasional; exposed channel margins and bed, in flood plain area in river cobbles above Highway 101; Riverine Emergent Wetland; MAR-OCT; *Magney et al. VR118* (UCSB), *Pollard s.n.* 29 AUG 1948, 14 AUG 1949, 21 JUL 1972 (PCF).

Persicaria amphibia (L.) Gray var. *emersa* (Michx.) Hickman [*Polygonum amphibium* L. var. *e.* Michx.]. Swamp Water Weed. Perennial aquatic herb; rare/rare; channel margins and bed, in the river at Main Street; Riverine Emergent Wetland; JUL-SEP; *Magney & Ferren VR-75-87* (UCSB).

Persicaria lapathifolium (L.) S.F. Gray. [*Polygonum lapathifolium* L.]. Willow Smartweed. Annual herb; occasional/scattered; margin of pool in riverbed; Riverine Emergent Wetland, Palustrine Emergent Wetland; JUN-OCT; *Pollard s.n.* 2 DEC 1971 (PCF).

Persicaria punctata (Ell.) Small [*Polygonum punctatum* Ell.]. Dotted Water Smartweed. Perennial aquatic herb; uncommon/occasional; channel margins and bed, in the river in gravel at the Main Street Bridge; Riverine Emergent Wetland; JUL-OCT; *Magney & Ferren VR-129-86 & VR-76-87* (UCSB).

**Polygonum arenastrum* Bor. Common Knotweed. Annual herb; occasional/ scattered; disturbed habitats, roadside in dune area W. of estuary; Ruderal Habitats; APR-OCT; *Pollard s.n.* 10 JUN 1972 (PCF, SBBG).

**Polygonum argyrocoleon* Steud. ex Kunze. Knotweed. Annual herb; flood plain, railroad; Ruderal Habitats; JUN-OCT; *Pollard s.n.* 29 AUG 1948 (PCF), 20 JUL 1970 (PCF, SBBG).

**Polygonum aviculare* L. Common Knotweed. Annual herb; uncommon/rare; roadside, exposed riverbed and bars, alluvial (deltaic) terrace, in flood plain area above Highway 101; Ruderal Habitats, Palustrine Scrub/Shrub Wetland; MAY-NOV; (ERT 1986-1989), *Pollard s.n.* 25 MAY 1967 (PCF).

**Rumex conglomeratus* Murr. Green Dock. Perennial herb; uncommon/scattered; abandoned temporary channels, in flood plain area above Highway 101; Riverine Emergent Wetland, Palustrine Scrub/Shrub Wetland; APR-OCT; *Rindlaub et al. VR33* (UCSB).

**Rumex crispus* L. Curly Dock. Perennial herb; scattered/scattered; river mouth swale wetland, abandoned temporary channels, exposed riverbed and bars, in flood plain area east of estuary, in flood plain area above Highway 101; Riverine Emergent Wetland, Palustrine Emergent Wetland, Palustrine Scrub/Shrub Wetland; FEB-NOV; *Rindlaub et al. VR5, VR13* (UCSB).

Rumex maritimus L. [*R. fueginus* Phil.]. Golden Dock. Annual; rare/scattered; river channel margin, margin of flooded lagoon, Seaside Wilderness Park; Riverine Emergent Wetland, Estuarine Nonpersistent Emergent Wetland; *Ferren & Capelli VR174* (UCSB), *Pollard s.n.* 6 JUL 1963 (SBBG), 13 OCT 1945 (PCF).

Rumex salicifolius Weinm. [including *R. crassus* Rech. f.] Willow Dock. Perennial herb; uncommon/scattered; dune swale wetland, Emma Wood State Beach; Palustrine Emergent Wetland, Palustrine Scrub/Shrub Wetland; MAY-SEP; *Magney & Ferren VR-92-87* (UCSB), *Pollard s.n.* 22 SEP 1945, 10 JUL 1963, 20 JUL 1972 (PCF, SBBG).

PORTULACACEAE Purslane Family

**Portulaca oleracea* L. Purslane. Prostrate annual herb; uncommon/rare; exposed riverbed and bars, Palustrine Emergent Wetland; MAY-SEP; (ERT 1986-1989).

PRIMULACEAE Primrose Family

**Anagallis arvensis* L. var. *arvensis*. Scarlet Pimpernel. Annual herb; occasional/scattered; dune swale wetland, exposed riverbed and bars, flood plain area above Highway 101; Palustrine Scrub/Shrub Wetland; MAR-JUL; *Rindlaub et al. VR35*, *Pang 30* (UCSB).

RANUNCULACEAE Crowfoot Family

Clematis ligusticifolia Nutt. in T.& G. Virgin's Bower. Perennial vine; uncommon/scattered; alluvial (deltaic) terrace, in forested area west of river below railroad tracks, Emma Wood State Beach, Seaside Wilderness Park; Palustrine Scrub/Shrub Wetland, Palustrine Forested Wetland; MAR-AUG; *Magney et al. VR-98-87 (UCSB), Pollard s.n. 23 JUN 1946, 14 AUG 1949, 6 SEP 1962, 20 JUL 1970 (PCF).*

RHAMNACEAE Buckthorn Family

Ceanothus crassifolius Torr. Snowball, Hoaryleaf Ceanothus. Shrub; rare/(locally extirpated?); river mouth; Palustrine Scrub/Shrub Wetland; FEB-APR; *Pollard s.n.* 28 APR 1946 (PCF).

Ceanothus megacarpus Nutt. ssp. *megacarpus.* Bigpod Ceanothus. Shrub; rare/rare; alluvial (deltaic) terrace, in forested area on west side of river between railroad tracks and Highway 101, Emma Wood State Beach; Coastal Sage Scrub, Palustrine Scrub/Shrub Wetland; JAN-APR; *Magney et al. VR-147-87* (UCSB).

Ceanothus oliganthus Nutt. in T.& G. Hoary Ceanothus. Shrub; rare/ rare; alluvial (deltaic) terrace, in flood plain area on east side of river just below Main Street; Palustrine Scrub/Shrub Wetland; FEB-APR; *Magney et al. VR10* (UCSB).

ROSACEAE Rose Family

**Cotoneaster pannosa* Franch. Cotoneaster. Shrub; rare/rare; river bank near mouth; Ruderal Habitats; *Pollard s.n.* 31 DEC 1947 (PCF).

Heteromeles arbutifolia M. Roem. [*Photinia a.* Lindl.]. Toyon, Christmas-berry. Shrub/small tree; rare/rare; alluvial (deltaic) terrace, in flood plain area above Highway 101; Palustrine Scrub/Shrub Wetland, Palustrine Forested Wetland; APR- JUL; Rindlaub et al. VR65 (UCSB).

Potentilla anserina L. ssp. *pacifica* (J.T. Howell) Rousi. [*P. egedei* Wormsk. var. *grandis* (Rydb.) J.T. Howell]. Marsh Cinquefoil, Southern Silver- weed. Perennial herb; rare/common; river mouth swale wetland and marsh W. of estuary, Seaside Wilderness Park, Emma Wood State Beach; Palustrine Emergent Wetland; Magney et al. VR-158-87, Magney et al. VR160 (UCSB), Pollard *s.n.* 13 OCT 1945, 14 APR 1946, 9 AUG 1962 (PCF).

Rosa californica C. & S. California Wild Rose. Shrub; rare/ rare; alluvial (deltaic) terrace, in flood plain area above railroad tracks; Palustrine Scrub/Shrub Wetland, Palustrine Forested Wetland; MAY-AUG; (ERT 1986-1989).

Rubus ursinus C. & S. California Blackberry. Perennial vine; scattered/ common; dune swale wetland, alluvial (deltaic) terrace, abandoned temporary channels, in flood plain area above railroad tracks; Seaside Wilderness Park, Emma Wood State Beach; Palustrine Scrub/Shrub Wetland, Palustrine Forested Wetland; MAR-AUG; *Pang 35* (UCSB).

RUBIACEAE Madder Family

**Galium aparine* L. Common Bedstraw. Annual herb; uncommon/ scattered; alluvial (deltaic) terrace, in shade of willows above railroad tracks; Palustrine Forested Wetland; MAR-JUL; *Magney et al. VR159* (UCSB).

SALICACEAE Willow Family

**Populus alba* L. Silver Poplar. Shrub; rare/rare; mouth of river, thicket

bordering salt marsh, along river bank; Palustrine Scrub/Shrub Wetland, Palustrine Forested Wetland; MAR-APR; Pollard *s.n.* 17 SEP 1946, 14 AUG 1962 (CAS, SBBG).

Populus trichocarpa T. & G. var. *trichocarpa*. Black Cottonwood. Tree; uncommon/uncommon; alluvial (deltaic) terrace, along river above railroad and on west bank at Main Street, Emma Wood State Beach; Palustrine Forested Wetland; FEB-APR; *Rindlaub et al. VR72* (UCSB).

Salix laevigata Bebb. var. *laevigata*. Red Willow. Tree; scattered/uncommon; river channel margin below Main Street bridge; Palustrine Forested Wetland; MAR-MAY; *Magney et al. VR-140-87* (UCSB), *Rindlaub et al. VR24* (UCSB), *Pollard s.n.* 25 JAN 1948 (CAS).

Salix lasiandra Bebb. var. *lasiandra*. Yellow Willow. Tree; scattered/uncommon; river channel margin, along edge of river above Highway 101; Palustrine Forested Wetland; MAR-MAY; *Magney et al. VR-132-87*, *Rindlaub et al. VR76* (UCSB).

Salix lasiolepis Benth. var. *lasiolepis*. Arroyo Willow (Fig. VIII-11). Tree; common/abundant; margin of estuary, river channel margin, exposed riverbed and bars, alluvial (deltaic) terrace, abandoned temporary channels, exposed riverbed, throughout study area primarily above the railroad tracks, Emma Wood State Beach, Seaside Wilderness Park; Estuarine Scrub/Shrub Wetland, Palustrine Scrub/Shrub Wetland, Palustrine Forested Wetland; MAR-MAY; (ERT 1986-1989), *Pollard s.n.* 27 JUN 1957, 29 FEB 1968 (CAS), 25 JAN 1948, 3 MAR 1946, 27 JUN 1957 (PCF).

Salix sessilifolia Nutt. [*S. hindsiana* Benth. var. *leucodendroides* (Rowlee) Ball.] Sandbar Willow. Shrub; uncommon/ uncommon; margin of estuary, river channel margin, abandoned temporary channels, along river above railroad tracks, Emma Wood State Beach; Estuarine Scrub/Shrub Wetland, Palustrine Scrub/Shrub Wetland, Palustrine Forested Wetland; MAR-MAY; *Magney & Ferren VR-136-86 & VR-83-87*, *Magney et al. VR-145-87*, *Rindlaub et al. VR74*, *Magney et al. VR147* (UCSB), *Pollard s.n.* 29 FEB 1968 (CAS), 7 AUG 1958, 20 JUN 1970 (PCF).

SAURURACEAE Lizard-tail Family

Anemopsis californica Hook. Yerba Mansa. Perennial herb; rare/rare; dune swale wetland at Emma Wood State Beach, river mouth swale at Seaside Wilderness Park; Palustrine Emergent Wetland; MAR-SEP; (ERT 1986-1989), *Pollard s.n.* 21 APR 1946 (SBBG).

SAXIFRAGACEAE Saxifrage Family

Ribes malvaceum Sm. var. *malvaceum*. Chaparral Currant. Shrub; rare/rare; one plant found in flood plain area above Highway 101; Palustrine Scrub/Shrub Wetland; OCT-MAR; *Pollard s.n.* 2 DEC 1971 (PCF).

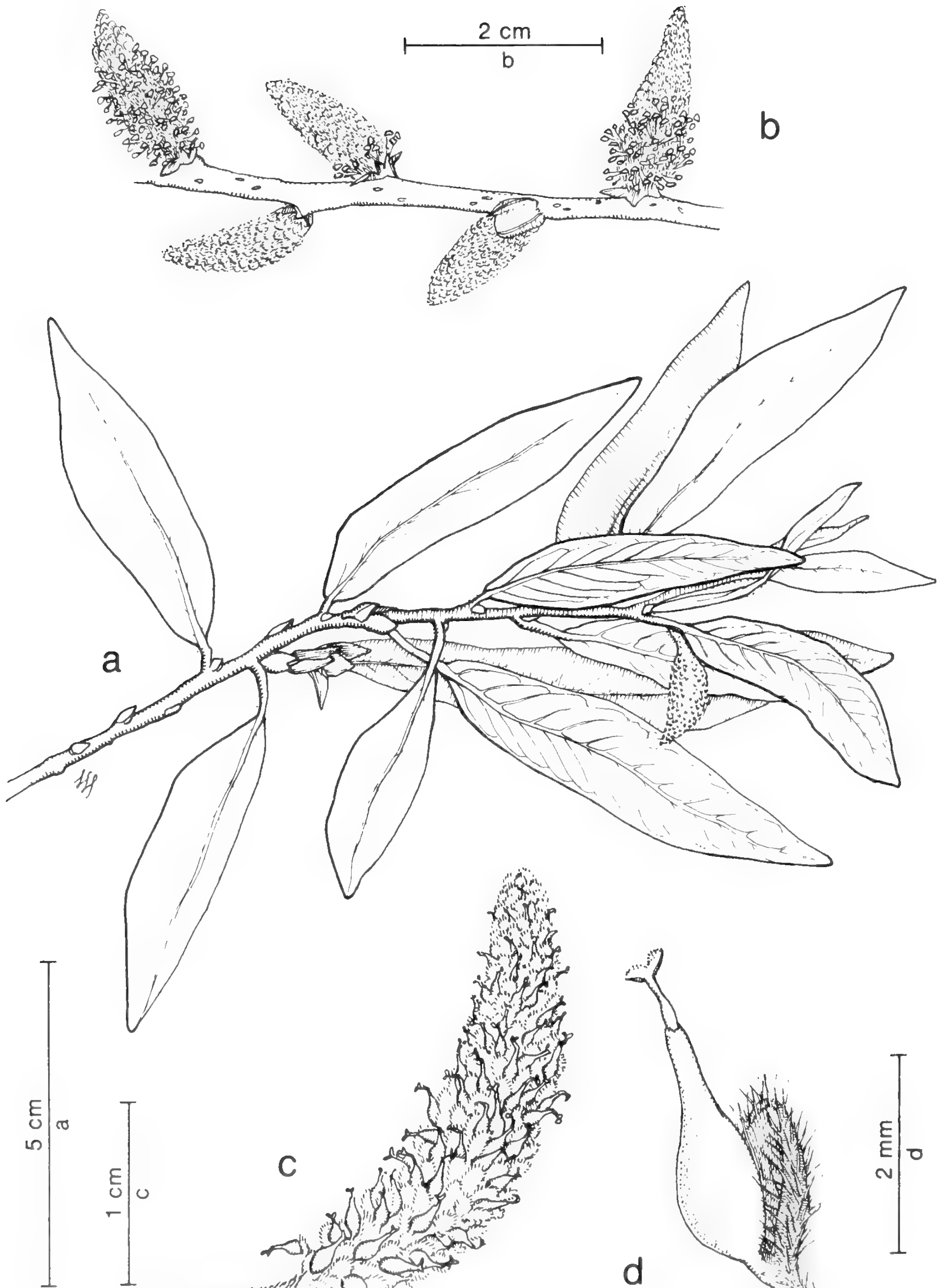

FIG. VIII-11. *Salix lasiolepis* Benth. Arroyo Willow.
a. Branch. b. Male catkins. c. Femlae catkin. d. Female flower.

SCROPHULARIACEAE Figwort Family

Antirrhinum multiflorum Penn. Sticky Snapdragon. Annual or perennial herb; rare/rare; behind dunes, exposed riverbed and bars, in flood plain area above Highway 101; Palustrine Scrub/Shrub Wetland; MAY-JUL; (ERT 1986-1989), *Pollard s.n.* 27 MAY 1967 (PCF).

Cordylanthus rigidus (Benth.) Jeps. ssp. *rigidus*. Bird's Beak. Annual; rare/(locally extirpated?); riverbed; AUG-SEP; *Pollard s.n.* 6 OCT 1945 (PCF).

Diplacus longiflorus Nutt. var. *longiflorus*. [*Mimulus longiflorus* (Nutt.) Grant] Bush Monkey Flower. Shrub; rare/rare; exposed riverbed and bars, in flood plain area between Highway 101 and Main Street; Palustrine Scrub/Shrub Wetland, Coastal Sage Scrub; FEB-OCT; *Magney et al. VR109* (UCSB).

Keckiella cordifolia (Benth.) Straw. [*Mimulus cordifolius* Benth.]. Heart-leaved Bush Penstemon. Shrub; rare/ rare; alluvial (deltaic) terrace, in flood plain area above Highway 101; Palustrine Scrub/Shrub Wetland, Palustrine Forested Wetland; FEB-AUG; Magney et al. VR101 (UCSB).

Scrophularia californica C. & S. var. *floribunda* Greene. Perennial herb; common/ scattered; alluvial (deltaic) terrace, scattered throughout flood plain area and forested area west of river above railroad tracks, Emma Wood State Beach, Seaside Wilderness Park; Palustrine Scrub/Shrub Wetland, Palustrine Forested Wetland; MAR-MAY; *Rindlaub et al. VR7*, *Magney et al. VR143* (UCSB).

**Veronica anagallis-aquatica* L. Water Speedwell. Perennial herb; scattered/common; channel margins and bed, river at Main Street; Riverine Emergent Wetland; MAY-SEP; *Rindlaub et al. VR25*, *Magney & Ferren VR-79-87* (UCSB).

SOLANACEAE Nightshade Family

Datura wrightii Regel. [*D. meteloides* DC.] Jimson Weed. Perennial herb; occasional/scattered; border of salt marsh, exposed riverbed and bars, alluvial (deltaic) terrace, in flood plain area above Highway 101, Palustrine Scrub/Shrub Wetland, Ruderal Habitats; APR-OCT; *Pang* 31 (UCSB), *Pollard s.n.* 6 SEP 1962 (PCF).

**Nicotiana glauca* Grah. Tree Tobacco. Shrub; scattered/ occasional; alluvial (deltaic) terrace, exposed riverbed and bars, abandoned temporary channels, beach dunes, scattered throughout study area, Emma Wood State Beach, Seaside Wilderness Park; Palustrine Scrub/Shrub Wetland, Southern Coastal Dunes, Ruderal Habitats; MAR-SEP; *Rindlaub et al. VR20* (UCSB), *Pollard s.n.* 21 OCT 1945, 17 NOV 1961 (PCF).

**Physalis philadelphica* Lam. Tomatillo. Annual; rare/rare; riverbed and sandy flat near river mouth; *Pollard s.n.* 6 OCT 1945, 27 OCT 1945, 7 NOV 1948 (PCF).

**Solanum americanum* Mill. [*S. nodiflorum* Jacq.] Small-flowered or White Nightshade. Annual or perennial herb; uncommon/ occasional; exposed riverbed and bars; alluvial (deltaic) terrace, in flood plain area above Highway 101; Palustrine Scrub/Shrub Wetland, Ruderal Habitats; APR-NOV; *Magney et al. VR-134-87* (UCSB), *Pollard s.n.* 15 OCT 1965 (PCF).

Solanum douglasii Dunal in DC. Douglas Nightshade. Perennial herb/shrub; common/occasional; exposed riverbed and bars, alluvial (deltaic) terrace, abandoned temporary channels, throughout study area; Palustrine Scrub/Shrub Wetland, Palustrine Forested Wetland; FEB-NOV; *Rindlaub et al. VR11*, *Pang 34* (UCSB), *Pollard s.n.* 27 OCT 1945 (PCF), 17 NOV 1961 (SBBG).

**Solanum rantonnetii* Carr. Blue Potato Bush. Shrub; rare/rare; long persistent in abandoned but once planted area W. of Ventura River; Ruderal Habitats; *Pollard s.n.* 18 AUG 1958 (PCF), 20 OCT 1959, 13 OCT 1965 (PCF, SBBG).

**Solanum rostratum* Dunal. Buffalo-bur. Annual herb; rare/rare; railroad, roadside, exposed riverbed and bars, alluvial (deltaic) terrace, in flood plain area above Highway 101; Palustrine Scrub/Shrub Wetland; MAY-SEP; (ERT 1986-1989), *Pollard s.n.* 20 JUL 1970 (PCF).

**Solanum sarrachoides* Sendt. ex. Mart. Hairy Nightshade. Shrub; rare/rare; bean field, river mouth; Ruderal Habitats; *Pollard s.n.* 21 SEP 1947 (PCF).

Solanum xantii Gray var. *xantii*. Purple Nightshade. Shrub; rare/rare; low area behind dunes, alluvial (deltaic) terrace, in flood plain area above Highway 101; Palustrine Scrub/Shrub Wetland; FEB-JUN; *Rindlaub et al. VR2*, *Magney et al. VR142, VR144 (UCSB), Pollard s.n.* 3 MAR 1946, 2 JUL 1966 (PCF), 24 FEB 1970 (SBBG).

TAMARICACEAE Tamarisk Family

**Tamarix ramosissima* Ledeb. [including citations for *T. pentandra* Pall. and *T. gallica* L.] Tamarisk, Salt Cedar. Shrub; scattered/uncommon; exposed riverbed, estuary margin, dune swale wetland, scattered in salt marsh area and dunes of Emma Wood State Beach; Palustrine Scrub/Shrub Wetland, Estuarine Persistent Emergent Wetland; *Pollard s.n.* 21 JUL 1946, 3 OCT 1948 (SBBG), 14 AUG 1962, 13 OCT 1965 (PCF), *Magney et al. VR-161-87* (UCSB), *Ferren & Capelli VR180* (UCSB), *Tamarix africana* Poir. reported at "Mouth of Ventura River" by Munz (1974). We have not seen a voucher for this report, which was the only citation for southern California by Munz.

TROPAEOLACEAE Tropaeolum Family

**Tropaeolum majus* L. Garden Nasturtium. Annual herb; occasional/ rare; dune swale wetland, channel margins and bed, back dune swale area of Emma Wood State Beach, along river back at Main Street; Palustrine Scrub/Shrub Wetland, Riverine Emergent Wetland, Palustrine Forested Wetland; JAN-NOV; *Magney & Ferren VR-72-87*, *Pang 22* (UCSB), *Pollard s.n.* 21 OCT 1945, 2 JUN 1963, 10 JUN 1972 (PCF).

URTICACEAE Nettle Family

Urtica dioica L. ssp. *gracilis* (Ait.) Seland. var. *holosericea* (Nutt.) C.L. Hitchc. Giant Creek Nettle, Hoary Nettle. Perennial herb; scattered/ common; alluvial (deltaic) terrace, abandoned temporary channels, scattered throughout moist areas

of study area; Palustrine Emergent Wetland, Palustrine Scrub/Shrub Wetland, Palustrine Forested Wetland; JUL-SEP, (ERT 1986-1989).

**Urtica urens* L. Dwarf Nettle. Annual herb; scattered/ common; alluvial (deltaic) terrace, scattered throughout moist areas of study area, Group Camp, Emma Wood State Beach; Palustrine Scrub/Shrub Wetland, Palustrine Forested Wetland, Ruderal Habitats; JAN-APR; *Magney et al. VR103* (UCSB).

VERBENACEAE Vervain Family

Verbena lasiostachys Link. Hairy-spike Verbena. Perennial herb; scattered/ occasional; exposed channel margins and bed, exposed riverbed and bars, alluvial (deltaic) terrace, in flood plain area in moist soil above Highway 101; Riverine Emergent Wetland, Palustrine Scrub/Shrub Wetland; MAY-SEP; *Rindlaub et al. VR1, VR41, Magney & Ferren VR-86-87, VR-86a-87 & VR-86b-87, Magney et al. VR153, Pang 32* (UCSB), *Pollard s.n.* 9 AUG 1962, 13 OCT 1965 (PCF).

SUBCLASS MONOCOTYLEDONEAE

AMARYLLIDACEAE Amaryllis Family

**Allium neapolitanum* Cyr. Onion. Perennial herb; rare/rare; channel margins and bed, along river bank in moist soil at Main Street bridge; Riverine Emergent Wetland; Summer; *Magney & Ferren VR-88-87* (UCSB).

**Amaryllis belladona* L. Naked Lady, Belladonna Lily. Perennial herb; rare/rare; flood plain near river mouth; *Pollard s.n.* 1 AUG 1958 (PCF).

**Narcissus tazetta* L. Polyanthus Narcissus. Perennial herb; rare/rare; behind beach dunes near river mouth; *Pollard s.n.* 3 MAR 1946, 1 Feb 1947 (PCF).

ARACEAE Arum Family

**Zantedeschia aethiopica* (L.) Spreng. [*Calla a.* L.]. Calla Lily. Perennial herb; rare/ rare; channel margins and bed, in moist soil on river bank at Main Street bridge; Riverine Emergent Wetland; NOV-MAY; *Magney & Ferren VR-69-87, Magney et al. VR158* (UCSB).

ARECACEAE Palm Family

**Phoenix dactylifera* L. H. Wendl. Date Palm. Tree; rare/rare; planted in Hobo Jungle area, Seaside Wilderness Park; (ERT 1986-1989).

CYPERACEAE Sedge Family

Carex barbarae Dewey. Santa Barbara Sedge. Perennial herb; rare/(extirpated locally?); salt marsh W. of estuary, lowland at river mouth, base of railroad embankment; Estuarine Emergent Wetland, Palustrine Emergent Wetland; MAR-

NOV; *Pollard s.n.* 21 APR 1946; 1 AUG 1958 (PCF), 19 MAY 1946, 9 AUG 1962 (PCF, SBBG).

Carex praegracilis W. Boott. Cluster Field-sedge. Perennial herb; rare/(extirpated locally?); river mouth, base of railroad at second mouth; Palustrine Emergent Wetland, Estuarine Emergent Wetland; MAR-JUN; *Pollard s.n.* 7 APR 1946 (PCF), 23 JUN 1946, 2 JUN 1963 (PCF, SBBG).

**Cyperus alternifolius* L. African Umbrella-sedge. Perennial herb; uncommon/ scattered; channel margins and bed, in saturated soil on river bank at Main Street Bridge; Riverine Emergent Wetland, Palustrine Emergent Wetland; JAN-NOV; *Magney & Ferren VR-87-87* (UCSB).

Cyperus eragrostis Lam. Tall Umbrella-sedge. Perennial herb; scattered/ scattered; river mouth, channel margins and bed, river bank at Main Street Bridge; Riverine Emergent Wetland, Palustrine Emergent Wetland, Estuarine Emergent Wetland; MAY-NOV; *Rindlaub et al. VR28, VR47, VR83, Magney & Ferren VR-77-87* (UCSB), *Pollard s.n.* 13 OCT 1945 (PCF).

**Cyperus esculentus* L. Yellow Nut-grass. Perennial herb; uncommon/ scattered; channel margins and bed, river mouth, river bank at Main Street Bridge; Riverine Emergent Wetland, Estuarine Emergent Wetland; JUN-OCT; *Magney & Ferren VR-82-87* (UCSB), *Pollard s.n.* 6 OCT 1945 (PCF).

Cyperus ferax L. C. Rich. Coarse Cyperus. Annual; uncommon/uncommon; river channel and estuary margins; Riverine Emergent Wetland, Estuarine Emergent Wetland, Seaside Wilderness Park, Hubbard Property; JUL-NOV; *Ferren & Capelli VR176* (UCSB).

Eleocharis palustris (L.) R. & S. [*E. macrostachya* Britt. in Small]. Pale Spike-rush. Perennial herb; rare/ rare; abandoned temporary channels, along east side of river, salt marsh north of railroad at second mouth, Emma Wood State Beach; Palustrine Emergent Wetland, Estuarine Emergent Wetland; APR-NOV; *Magney et al. VR166* (UCSB).

Scirpus acutus Muhl. ex Bigel. Common Tule. Perennial herb; rare/(locally extirpated?); brackish pond and marsh W. of river; Estuarine Emergent Wetland, Palustrine Emergent Wetland, JUN-NOV; *Pollard s.n.* 26 JUL 1963 (PCF, SBBG).

Scirpus californicus (C. A. Mey.) Steudel. California Bulrush, California Tule; (Fig. VIII-12). Perennial herb; common/scattered; river channel margins, dune swale wetland, river mouth swale wetland, estuary basin, margin of estuary, Main Street to mouth of river and at second mouth; Palustrine Emergent Wetland, Estuarine Persistent Emergent Wetland; JUN-SEP; *Magney & Ferren VR-126-86, Magney et al. VR151, Rindlaub et al. VR78* (UCSB), *Pollard s.n.* 10 NOV 1971 (SBBG), 13 OCT 1945, 21 JUL 1946 (PCF).

Scirpus cernuus Vahl ssp. *californicus* (Torr.) Thorne. Low Club-rush. Perennial herb; occasional/(locally extirpated?); river mouth and bed; Estuarine Emergent Wetland, Palustrine Emergent Wetland; MAR-SEP; *Pollard s.n.* 27 OCT 1945, 14 AUG 1949 (PCF).

Scirpus maritimus L. Prairie or Alkali Bulrush (Fig. VIII-13). Perennial herb; occasional/common; estuary of second mouth and main mouth, Emma Wood

State Beach and Seaside Wilderness Park; Estuarine Persistent Emergent Wetland; JUN-SEP; *Rindlaub et al. VR68*, *Magney & Ferren VR-96-87*, *Magney et al. VR-152-87* (UCSB), *Pollard s.n.* 6 OCT 1945 (SBBG), 21 OCT 1945, 3 SEP 1948 (PCF).

Scirpus pungens Vahl (*S. americanus* of authors, not Pers.). Three Square. Perennial rhizomatous herb; uncommon/ uncommon; river mouth swale wetland, margins of estuary, along estuary below Highway 101; Palustrine Emergent Wetland, Estuarine Persistent Emergent Wetland; JUN-SEP; *Pollard s.n.* 29 SEP 1945, 13 OCT 1945, 3 OCT 1948 (PCF).

JUNCACEAE Rush Family

Juncus acutus L. var. *sphaerocarpus* Engelm. Southwestern Spiny Rush. Perennial herb; rare/ rare; river mouth swale wetland, east side of estuary below railroad bridge, Seaside Wilderness Park; Palustrine Emergent Wetland; MAY-JUN; *Rindlaub et al. VR70*, *Magney et al. VR162* (UCSB), *Pollard s.n.* 6 OCT 1945, 10 OCT 1948, 17 NOV 1961 (PCF).

Juncus mexicanus Willd. Mexican Rush. Perennial herb; occasional/(locally extirpated?); beach near river mouth, salt marsh W. of estuary; Palustrine Emergent Wetland, Estuarine Emergent Wetland; APR-JUL; *Pollard s.n.* 29 SEP 1945, 6 JUL 1962 (PCF).

Juncus textilis Buch. Basket Rush, Indian Rush. Perennial herb; rare/common; dune swale wetland, roadside near mouth, and bank of railroad, Emma Wood State Beach; Palustrine Emergent and Scrub/Shrub Wetland; MAY-JUN; *Magney et al. VR-155-87* (UCSB), *Pollard s.n.* 22 SEP 1945, 10 OCT 1948 (PCF).

Juncus xiphioides E. Mey. Iris-leaved Rush. Perennial herb; uncommon/rare; river channel margins, along river bank at Highway 101 and Main Street Bridge; Palustrine Emergent Wetland, Riverine Emergent Wetland; MAY-OCT; *Rindlaub et al. VR69*, *Magney & Ferren VR-78-87* (UCSB), *Pollard s.n.* 6 OCT 1945 (PCF).

LEMNACEAE Duckweed Family

Lemna gibba L. Gibbous Duckweed. Annual floating herb; occasional/abundant; brackish pond W. of river mouth; Riverine Aquatic Bed Wetland, Estuarine Aquatic Bed Habitat, Palustrine Aquatic Bed Wetland; MAR-OCT; *Pollard s.n.* 9 AUG 1962, 16 SEP 1962 (PCF).

Lemna minor L. Water Lentil, Lesser Duckweed. Annual herb; common/abundant; floating in estuary and in river; Estuarine Aquatic Bed Wetland, Riverine Aquatic Bed Wetland; MAR-OCT; *Magney & Ferren VR-73-87* (UCSB), *Ferren & Capelli VR-172, 173* (UCSB).

LILIACEAE Lily Family

**Asphodelus fistulosus* L. Asphodel. Perennial herb; uncommon/ scattered; ruderal fill habitat, along railroad tracks, Emma Wood State Beach; Ruderal Habitats; MAR-JUN; *Pang* 23 (UCSB).

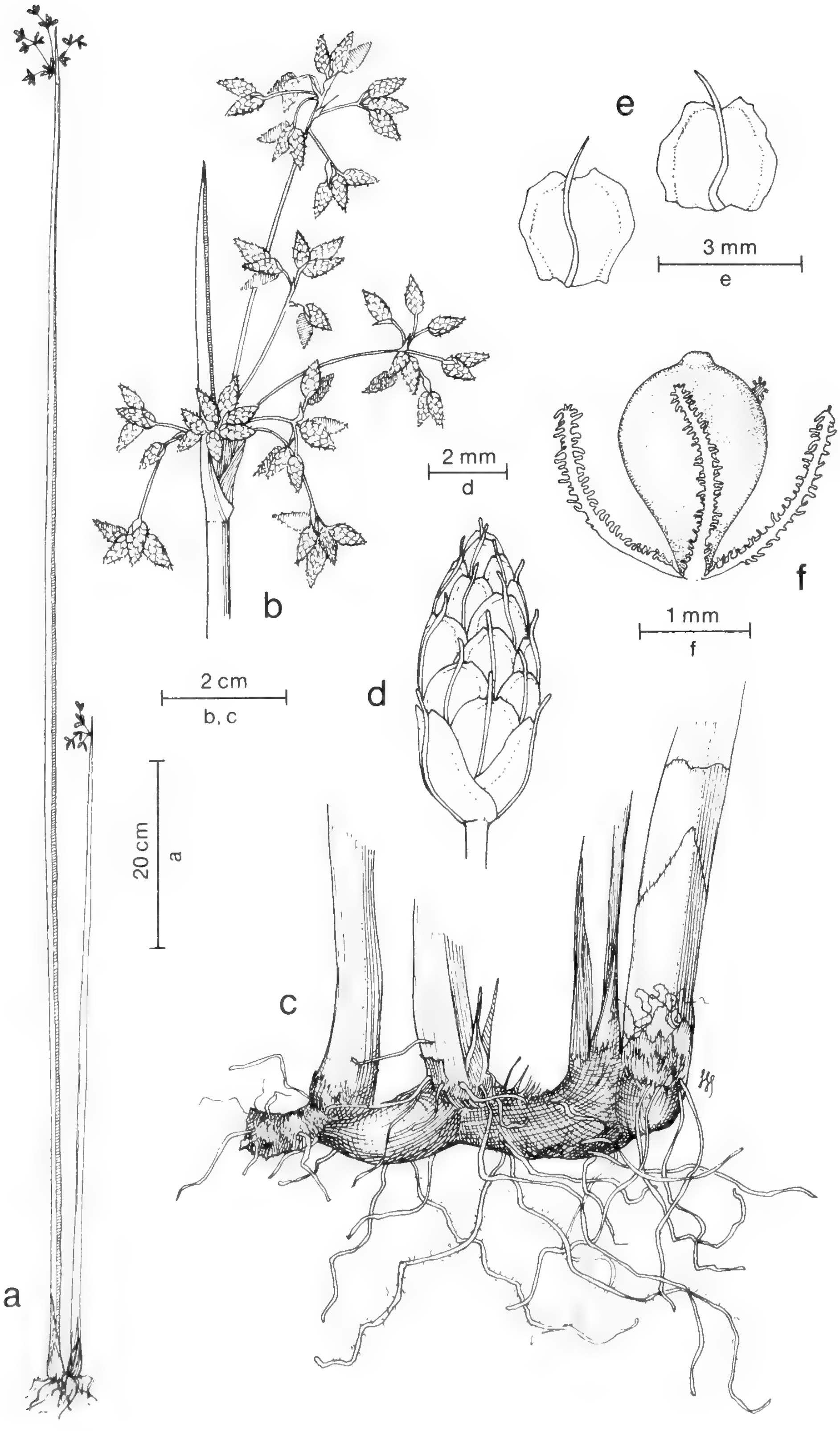

FIG. VIII-12. *Scirpus californicus* (C.A. Mey.) Steudel. California Bulrush. a. Habit. b. Inflorescence with numerous spikelets. c. Rhizome and bases of shoots. d. Spikelet. e. Scales. f. Achene with bristles.

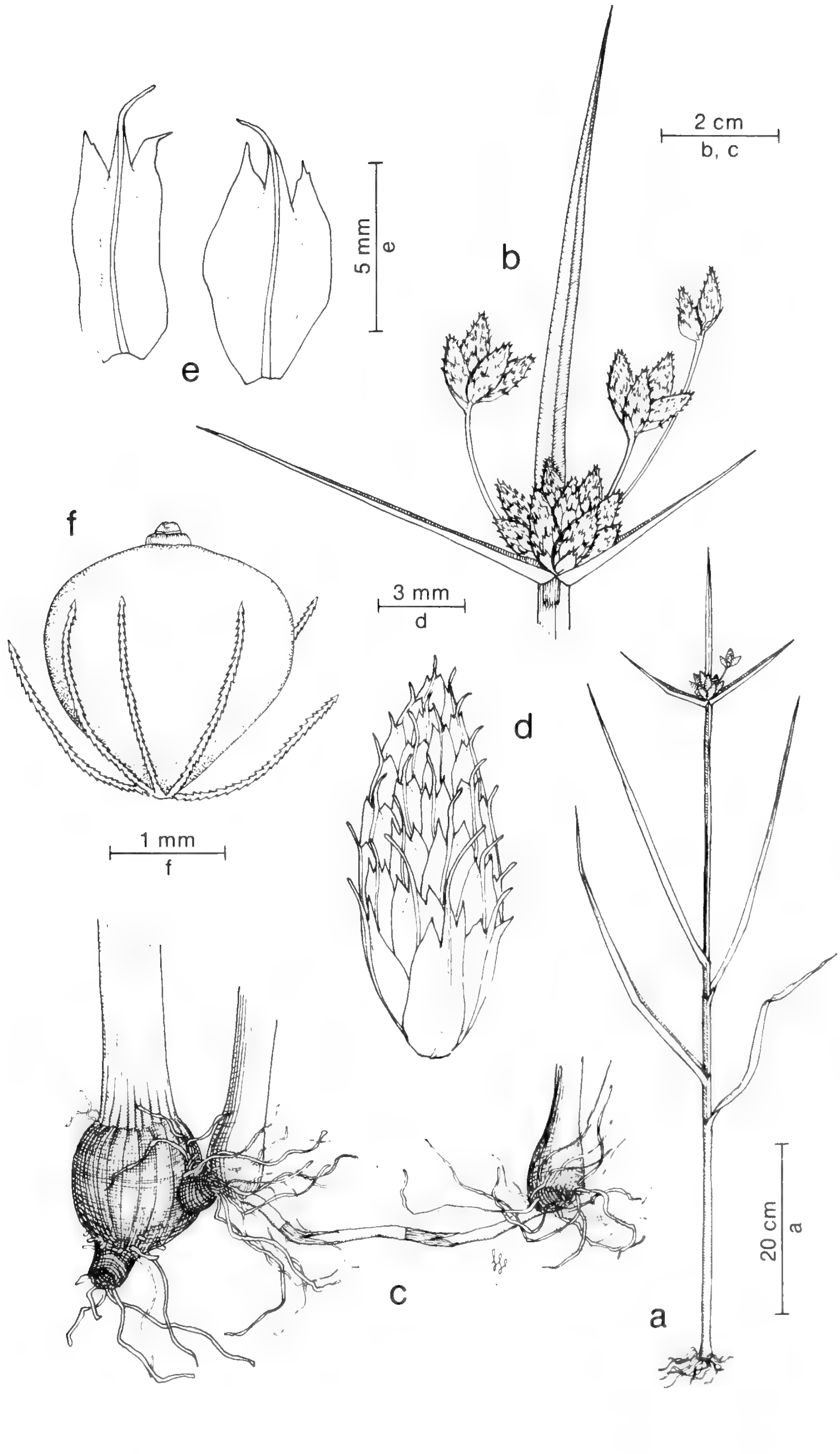

FIG. VIII-13. *Scirpus maritimus* L. Prairie Bulrush.
a. Habit. b. Inflorescence. c. Tuberous rhizome and bases of shoots. d. Spikelet. e. Scales. f. Achene with bristles.

POACEAE Grass Family

**Agropyron elongatum* (Host) Beauv. Tall Wheatgrass. Perennial grass; rare/rare; Ruderal Habitats; *Magney & Ferren VR-140-86* (UCSB).

**Agrostis semiverticillata* (Forsk.) C. Chr. Water Bent Grass, Redtop. Perennial grass; occasional/ common; channel margins and bed, along riverbank above Highway 101; Riverine Emergent Wetland; JUN-NOV; *Rindlaub et al. VR36*, *Magney et al. VR-135-87* (UCSB).

**Arundo donax* L. [including *A*. d. var. *versicolor*] Giant Reed. Perennial grass; common/common; exposed riverbed and bars, alluvial (deltaic) terrace, abandoned temporary channels, margins of estuary, dune swale wetland, throughout study area, Emma Wood State Beach, Seaside Wilderness Park; Ruderal Habitats, Palustrine Emergent Wetland, Palustrine Scrub/Shrub Wetland, Estuarine Persistent Emergent Wetland; MAR-SEP; *Rindlaub et al. VR66* (UCSB), *Pollard s.n.* 20 OCT 1945, 2 OCT 1959, 4 AUG 1970 (PCF).

**Avena barbata* Brot. Slender Wild Oat. Annual grass; scattered/ common; exposed riverbed and bars, alluvial (deltaic) terrace, in flood plain area above Highway 101; Ruderal Habitats, Palustrine Scrub/Shrub Wetland; MAR-JUN; *Magney et al. VR106* (UCSB).

**Avena fatua* L. Wild Oat. Annual grass; uncommon/scattered; exposed riverbed and bars, alluvial (deltaic) terrace, ruderal fill habitat, in flood plain area above Main Street, on levee near river mouth below railroad tracks, Seaside Wilderness Park; Ruderal Habitats, Palustrine Scrub/Shrub Wetland; APR-JUN; (ERT 1986-1989).

**Avena sativa* L. Cultivated Oat. Annual grass; scattered/ uncommon; ruderal fill habitat, on levee near mouth below railroad tracks, Seaside Wilderness Park; Ruderal Habitats; APR- JUN; (ERT 1986-1989).

**Brachypodium distachyon* (L.) Beauv. Purple False Brome. Annual grass; rare/ rare; observed along vegetation transect; Palustrine Scrub/Shrub Wetland; APR-MAY; (ERT 1986-1989).

Bromus carinatus H. & A. California Brome. Perennial grass; uncommon/ scattered; alluvial (deltaic) terrace, exposed riverbed and bars, in flood plain area above Highway 101; Palustrine Scrub/Shrub Wetland, Palustrine Forested Wetland, Ruderal Habitats; APR-AUG; Rindlaub et al. VR30 (UCSB).

**Bromus diandrus* Roth. Ripgut Grass. Annual grass; scattered/ scattered; dune swale wetland, alluvial (deltaic) terrace, in flood plain area above Highway 101; Ruderal Habitats, Palustrine Scrub/Shrub Wetland; APR-JUN; *Rindlaub et al. VR8* (UCSB).

**Bromus hordeaceus* L. ssp. hordeaceus [*B. mollis* L.] Soft Chess. Annual grass; scattered/ scattered; alluvial (deltaic) terrace, exposed riverbed and bars, in flood plain area above Highway 101. dune swale wetland; Ruderal Habitats, Palustrine Emergent Wetland, Palustrine Scrub/Shrub Wetland; APR-JUL; Rindlaub et al. VR30 (UCSB), *Pollard s.n.* 6 APR 1967 (PCF).

**Bromus rubens* L. Red Brome. Annual grass; scattered/occasional; exposed riverbed and bars, alluvial (deltaic) terrace, dune swale wetland, in flood plain area above Main Street; Ruderal Habitats, Palustrine Scrub/Shrub Wetland; MAR-JUN; *Rindlaub et al. VR42* (UCSB).

**Cortaderia jubata* Pampas Grass. Perennial grass; rare/ rare; north of railroad tracks just above second mouth, Emma Wood State Beach; Estuarine Emergent Wetland, Palustrine Scrub/Shrub Wetland; JUL-OCT; (ERT 1986-1989).

**Crypsis niliaca* Fig. & DeNot. Sharp-leaved Crypsis. Prostrate annual grass; rare/ rare, exposed channel margins and bed, vicinity of Main Street bridge; Riverine Emergent Wetland; JUN-SEP; *Magney & Ferren VR-133-86* (UCSB).

**Cynodon dactylon* (L.) Pers. Bermuda Grass. Perennial grass; uncommon/ abundant; disturbed areas, margins of estuary, exposed channel margins and bed, on bar in rocky mudflats of estuary and along river bank above Highway 101; Ruderal Habitats, Estuarine Nonpersistent Emergent Wetland, Riverine Emergent Wetland; APR-OCT; *Rindlaub et al. VR67*, *Magney et al. VR116* (UCSB).

Distichlis spicata (L.) Greene var. *spicata*. Coastal Saltgrass. Perennial grass; scattered/ common; estuary margin, dune swale wetland, river mouth swale wetland, alluvial (deltaic) terrace, edge of second mouth, dunes, flood plain area in vicinity of Main Street bridge, Seaside Wilderness Park, Emma Wood State Beach; Estuarine Emergent Wetland, Palustrine Emergent Wetland, Southern Coastal Dunes; APR-JUL; *Magney et al. VR136* (UCSB), *Pollard s.n.* 13 OCT 1945, 21 APR 1946 (PCF).

**Echinochloa crusgalli* (L.) Beauv. Barnyard Grass. Annual grass; uncommon/uncommon; margin of estuary along sand and cobble bar at mouth, Seaside Wilderness Park; Estuarine EmergentWetland, Riverine Emergent Wetland; *Ferren and Capelli VR-178* (UCSB), *Pollard s.n.* 29 SEP 1945 (PCF).

Elymus condensatus Presl. Giant Rye. Perennial grass; uncommon/common; dune swale wetland, in back dune swale area just south of railroad tracks east of second mouth, Emma Wood State Beach; Palustrine Scrub/Shrub Wetland, Ruderal Habitats; JUN-AUG; *Magney et al. VR144* (UCSB), *Pollard s.n.* 1 JUN 1946, 22 NOV 1962 (PCF).

Elymus triticoides Buckl. Alkali Rye. Perennial grass; uncommon/common; dune swale wetland, river mouth swale wetland, Hobo Jungle south of railroad tracks and on both sides of estuary, Seaside Wilderness Park; Palustrine Emergent Wetland; JUN-JUL; *Magney et al. VR143* (UCSB), *Pollard s.n.* 29 SEP 1945, 2 MAR 1947 (PCF).

**Festuca arundinacea* Schreb. Alta or Reed Fescue. Perennial grass; rare/rare; railroad, channel margins and bed, on river bank between Highway 101 and Main Street; Riverine Emergent Wetland, Ruderal Habitats; MAY-JUN; *Magney & Ferren VR-81-87* (UCSB), *Pollard s.n.* 28 APR 1946, 18 SEP 1955 (PCF).

**Hordeum murinum* L. ssp. *leporinum* (Link.) Arcangeli. [*H. leporinum* Link.]. Hare Barley. Annual grass; uncommon/scattered; exposed riverbed and bars, alluvial (deltaic) terrace, in flood plain area near Main Street Bridge; Ruderal Habitats, Riverine Emergent Wetland, Palustrine Scrub/Shrub Wetland, Southern Coastal Dunes; APR-JUN; *Rindlaub et al. VR19*, *Pang 28* (UCSB).

**Hordeum vulgare* L. Cultivated Barley. Annual herb; rare/scattered; flat between railroad and beach W. of river; Ruderal Habitats; *Pollard s.n.* 21 APR 1966 (PCF).

**Lamarkia aurea* (L.) Moench. Goldentop. Annual grass; rare/rare; exposed channel margins and bed, alluvial (deltaic) terrace, on rocky banks of river above Highway 101 and in flood plain area in vicinity of Main Street; Ruderal Habitats, Riverine Emergent Wetland, Palustrine Scrub/Shrub Wetland; FEB-MAY; (ERT 1986-1989).

**Leptochloa uninervia* (Presl.) Hitchc. & Chase. Mexican Spangletop. Annual; scattered/uncommon; river channel margin and margin of lagoon when flooded; Riverine Emergent Wetland, Estuarine Nonpersistent Emergent Wetland; *Ferren & Capelli VR175* (UCSB).

**Lolium multiflorum* Lam. [*L. perenne* L. ssp. *m.* (Lam.) Husnot.]. Italian Ryegrass. Annual or biennial grass; scattered/ common; exposed riverbed and bars, alluvial (deltaic) terrace, along river bank in flood plain area in vicinity of Main Street Bridge; Ruderal Habitats, Palustrine Scrub/Shrub Wetland; APR-JUL; *Rindlaub et al. VR38* (UCSB).

**Oryzopsis miliacea* (L.) Beth. & Hook. ex Ascher & Schweinf. Smilo Grass or Millet Ricegrass. Perennial grass; scattered/ common; exposed riverbed and bars, alluvial (deltaic) terrace, abandoned temporary channels, throughout study area such as flood plain above Highway 101, Emma Wood State Beach; Ruderal Habitats, Palustrine Scrub/Shrub Wetland, Palustrine Forested Wetland; APR-SEP; *Rindlaub et al. VR81* (UCSB).

**Panicum capillare* L. var. *occidentale* Rydb. Western Witchgrass. Annual grass; rare/ rare; disturbed habitat, in ruderal area on levee on east side of river below railroad tracks, Seaside Wilderness Park; Ruderal Habitats; JUL-SEP; (ERT 1986-1989).

**Parapholis incurva* (L.) C. E. Hubb. Sickle Grass. Annual herb; occasional/ common; beach, river mouth, sandy flat behind beach W. of estuary; *Pollard s.n.* 1 JUN 1946, 21 APR 1966 (PCF).

**Paspalum dilatatum* Poir. Dallis Grass. Perennial grass; rare/ rare; disturbed habitat, in ruderal area on levee on east side of river below railroad tracks, Seaside Wilderness Park; Ruderal Habitats; MAY-NOV; (ERT 1986-1989).

**Pennisetum clandestinum* Hochst. ex Chiov. Kikuyu Grass. Perennial grass forming dense mats; occasional/ abundant; river mouth swale wetland, alluvial (deltaic) terrace, margin of estuary, in moist soil along edge of estuary below railroad tracks and flood plain area to above Main Street, Emma Wood State Beach, Seaside Wilderness Park; Estuarine Persistent Emergent Wetland, Estuarine Scrub/Shrub Wetland, Palustrine Emergent Wetland, Ruderal Habitats; JUL-AUG; *Magney et al. VR128* (UCSB), *Pollard s.n.* 10 NOV 1971 (PCF).

**Pennisetum setaceum* (Forsk.) Chiov. Fountain Grass. Perennial; uncommon/scattered; seaside margin and banks along Hwy. 101; Ruderal Habitats; (ERT 1986-1989).

**Pennisetum villosum* R. Br. Feathertop. Perennial grass; scattered/occasional; disturbed habitats, in ruderal areas along railroad tracks, Seaside Wilderness Park, Emma Wood State Beach; Ruderal Habitats; JUN-AUG; *Magney & Ferren VR-125-86* (UCSB), *Pollard s.n.* 12 JUL 1946 (PCF).

**Phalaris* sp. Canary Grass. Perennial or annual grass; rare/ rare; exposed riverbed and bars, alluvial (deltaic) terrace, in flood plain area above Highway 101; Palustrine Scrub/Shrub Wetland; APR-JUL; (ERT 1986-1989).

**Poa annua* L. Annual Bluegrass or Wintergrass. Annual grass; rare/ rare; exposed channel margins and bed, in sand and cobbles of riverbed above Highway 101; Riverine Emergent Wetland; JAN-JUL; *Magney et al. VR114* (UCSB).

**Polypogon monspeliensis* (L.) Desf. Rabbitfoot Grass. Annual grass; scattered/ common; channel margins and bed, in saturated soil of river bank at Main Street; Riverine Emergent Wetland; APR-AUG; *Rindlaub et al. VR34*, *Pang 42* (UCSB), *Pollard s.n.* 21 APR 1946 (PCF).

**Schismus barbatus* (L.) Thell. Arabian Grass. Annual grass; uncommon/ occasional; exposed riverbed and bars, alluvial (deltaic) terrace, in flood plain area below Highway 101; Riverine Emergent Wetland, Palustrine Scrub/Shrub Wetland; MAR-APR; *Rindlaub et al. VR75*, *Magney et al. VR152* (UCSB).

**Sorghum bicolor* (L.) Moench. Sorghum, Broom Corn. Annual herb; uncommon/ uncommon; railroad W. of estuary; Ruderal Habitats; *Pollard s.n.* 20 JUL 1970 (PCF).

Vulpia myuros (L.) K.C. Gmelin var. *hirsuta* Hack. [*V. megalura* Rydb., *Festuca m.* Nutt.]. Foxtail Fescue. Annual grass; scattered/ occasional; exposed channel margins and bed, exposed riverbed and bars, alluvial (deltaic) terrace, on rocky banks of river and in flood plain area above Highway 101; Riverine Emergent Wetland, Palustrine Emergent Wetland, Palustrine Scrub/Shrub Wetland; APR-JUN; *Rindlaub et al. VR79*, *Magney et al. VR145* (UCSB).

**Zea mays* L. Cultivated corn. Annual herb; uncommon/uncommon; railroad siding W. of estuary; Ruderal Habitats; *Pollard s.n.* 20 JUL 1970 (PCF).

POTAMOGETONACEAE Pondweed Family

Potamogeton foliosus Raf. Leafy Pondweed. Perennial aquatic herb; river channel bed, river near ocean; Riverine Aquatic Bed Wetland; MAR-NOV; *Pollard s.n.* 6 OCT 1945 (PCF), C. Smith (1976).

Potamogeton pectinatus L. Fennel Pondweed. Perennial aquatic herb; rare/rare; river mouth, estuary north of Highway 101; Estuarine Aquatic Bed Deepwater Habitat; *Ferren 2122* (UCSB), *Pollard s.n.* 23 JUN 1946 (SBBG), 14 AUG 1943, 20 OCT 1945.

Ruppia cirrhosa (Petag.) Grande. [*R. spiralis* L. ex Dumort.]. Spiral Ditch-grass. Perennial aquatic herb; rare/abundant; floating in estuary at river mouth, Seaside Wilderness Park; rooted in permanently flooded portion of second mouth, Emma Wood State Beach; Estuarine Aquatic Bed Deepwater Habitat; JUN-NOV; *Magney & Ferren VR-93-87*, *Ferren s.n.* 8 OCT 1988 (UCSB). A report of *R.*

maritima L. from the mouth of the Ventura River [*Pollard s.n.* 27 OCT 1945 (PCF)] might be a misidentification of *R. cirrhosa*.

TYPHACEAE Cattail Family

Typha angustifolia L. (?). Narrowleaf Cattail. Perennial herb; river mouth; Estuarine Emergent Wetland, Palustrine Emergent Wetland; *Pollard s.n.* 3 OCT 1948, 14 AUG 1949 (PCF).

Typha domingensis Pers. Narrowleaf Cattail. Perennial herb; scattered/ common; margin of estuary, river channel margins, dune swale wetland, along bank of estuary and river from above Main Street to vicinity of railroad bridge; Estuarine Persistent Emergent Wetland, Palustrine Emergent Wetland; JUN-JUL; *Rindlaub et al. VR71* (UCSB).

Typha domingensis Pers. X *T. latifolia* L.(?) Narrowleaf Cattail hybrid. Perennial herb; rare/uncommon; margin of estuary/river channel, rooted along bank of river above Highway 101 in transition area between estuary and river; Estuarine Persistent Emergent Wetland, Palustrine Emergent Wetland; JUN-JUL; *Magney et al. VR-139-87* (UCSB).

Typha latifolia L. Broadleaf Cattail. Perennial herb; scattered/ common; river channel margins, rooted along bank of river near Main Street bridge; Palustrine Emergent Wetland; JUN-JUL; *Magney & Ferren VR-80-87* (UCSB), *Pollard s.n.* 13 AUG 1949 (PCF).

ZANNICHELLIACEAE Horned Pondweed Family

Zannichellia palustris L. Horned Pondweed. Perennial aquatic herb; rare/occasional; perennially flooded river channels, e.g., Shell Rd. Bridge, river mouth; Riverine Aquatic Bed Wetland, Estuarine Aquatic Bed Deepwater Habitat; JUN-OCT; *Ferren & Capelli VR173* (UCSB), *C. Smith* (1976), *Pollard s.n.* 13 JUN 1946 (SBBG), 1 JUN 1946, 3 OCT 1948, 7 NOV 1948 (PCF).

ZOSTERACEAE Eel-grass Family

Phyllospadix scouleri Hooker (?) Surf Grass. Perennial marine herb; apparently uncommon: cobble intertidal shores, cobble bottom; Marine Intertidal Wetland, Marine Subtidal Deepwater Habitat; MAY-NOV; *Dawson 15751*, 12 DEC 1956 (LAM). Record based on material of uncertain identity.

Phyllospadix torreyi Wats. Surf Grass. Perennial marine herb; common/scattered; cobble intertidal shores, cobble subtidal bottom, entire shoreline along Ventura River Delta; Marine Intertidal Wetland, Marine Subtidal Deepwater Habitat; MAY-NOV; *Capelli et al. s.n.* 2 JUL 88, 17 JUL 88, 19 APR 87 (UCSB), *Pollard s.n.* 20 OCT 1945 (SBBG), 22 SEP 1945, 1 JUN 1946 (PCF); *Dawson 15768*, 16 DEC 1956, *17305*, 28 JUL 1957, *20718*, 6 FEB 1959 (LAM).

APPENDIX IX

CHECKLIST OF THE VASCULAR PLANTS

A: THE STUDY AREA: VENTURA RIVER GROUP CAMP, SEASIDE WILDERNESS PARK, AND THE HUBBARD PROPERTY CHECKLIST OF VASCULAR PLANTS AS CATALOGUED IN APPENDIX VIII

SCIENTIFIC NAME	COMMON NAME
Abronia maritima	Sticky Sand-verbena
Abronia umbellata	Beach Sand-verbena
*Agropyron elongatum**	Tall Wheatgrass
*Agrostis semiverticillata**	Redtop, Water Bent Grass
*Allium neapolitanum**	Onion
Alnus rhombifolia	White Alder
*Amaranthus albus**	Tumbleweed
*Amaranthus deflexus**	Prostrate Amaranth
*Amaryllis belladona**	Naked Lady
Amblyopappus pusillus	Pineapple Weed
Ambrosia chamissonis ssp. *bipinnatisecta*	Beach-bur
Ambrosia psilostachya var. *californica*	Western Ragweed
Amsinckia menziesii	Rigid Fiddleneck
Amsinckia spectabilis var. *spectabilis*	Spectacular Fiddleneck
*Anagallis arvensis**	Scarlet Pimpernel
Anemopsis californica	Yerba Mansa
*Anthemis cotula**	Mayweed
Antirrhinum multiflorum	Sticky Snapdragon
*Apium graveolens**	Celery
*Artemisia biennis**	Marsh Sagebrush
Artemisia californica	California Sagebrush
Artemisia douglasiana	Mugwort
Artemisia dracunculus	Tarragon, Dragonwort
*Arundo donax**	Giant Reed
*Asphodelus fistulosus**	Asphodel
Aster subulatus ssp. *ligulatus*	Slender Marsh Aster
Astragalus trichopodus ssp. *trichopodus*	Three-podded Milk-vetch
Atriplex californica	California Saltbush
Atriplex coulteri	Coulter's Saltbush
Atriplex lentiformis ssp. *breweri*	Brewer's Saltbush
Atriplex lentiformis ssp. breweri X A. leucophylla	Hybrid Saltbush
Atriplex leucophylla	Whiteleaf Saltbush
Atriplex leucophylla X A. watsonii	Hybrid Saltbush
Atriplex patula ssp. *hastata*	Spear-leaved Saltbush
*Atriplex rosea**	Redscale
*Atriplex semibaccata**	Australian Saltbush
Atriplex serenana	Serano Watson's Saltbush
Atriplex serenana X A. argentea	Hybrid Saltbush
*Avena barbata**	Slender Wild Oat
*Avena fatua**	Wild Oat
*Avena sativa**	Oat
Azolla filiculoides	Duckweed Fern

* = naturalized or planted species

SCIENTIFIC NAME	COMMON NAME
Baccharis douglasii	Salt Marsh Baccharis
Baccharis pilularis ssp. *consanguinea*	Coyote Brush
Baccharis plummerae	Plummer's Baccharis
Baccharis salicifolia	Mule Fat
*Bassia hyssopifolia**	Fivehook
Berula erecta	Berula
*Beta vulgaris**	Garden Beet
*Boussingaultea gracilis**	Madeira Vine
*Brachypodium distachyon**	Purple False Brome
*Brassica geniculata**	Summer Mustard
*Brassica nigra**	Black Mustard
*Brassica oleracea**	Cabbage
Brassica rapa var. *sylvestris**	Field Mustard
Bromus carinatus	California Brome
*Bromus diandrus**	Ripgut Grass
Bromus hordeaceus ssp. *hordeaceus**	Soft Chess
*Bromus rubens**	Red Brome
Cakile edentula var. *californica*	California Sea-rocket
*Cakile maritima**	Sea- rocket
Calystegia macrostegia ssp. *cyclostegia*	Purple Bracted Morning-glory
Calystegia soldanella	Beach Morning-glory
Camissonia boothii ssp. *decorticans*	Evening-primrose
Camissonia cheiranthifolia ssp. *suffruticosa*	Beach Evening Primrose
Camissonia micrantha	Small Primrose
*Capsella bursa-pastoris**	Shepherd's Purse
Cardamine oligosperma	Few-seeded bittercress
Cardaria draba var. *draba**	Hoary Cress
*Carduus pycnocephalus**	Italian Thistle
Carex barbarae	Santa Barbara Sedge
Carex praegracilis	Sedge
*Carpobrotus aequilaterus**	Sea Fig
*Carpobrotus edulis**	Hottentot Fig
Ceanothus crassifolius	Snowball, Hoaryleaf Ceanothus
Ceanothus megacarpus ssp. *megacarpus*	Bigpod California Lilac
Ceanothus oliganthus	Hoary Ceanothus
*Centaurea melitensis**	Tocalote
*Centaurea repens**	Russian Knapweed
*Centaurea solstitialis**	Yellow Star Thistle
*Chenopodium ambrosioides**	Mexican Tea
Chenopodium berlandieri	Berlandier's Goosefoot
Chenopodium californicum	Soap Plant
Chenopodium macrospermum var. *farinosum*	Goosefoot
*Chenopodium missouriense**	Missouri Goosefoot
*Chenopodium murale**	Nettle-leaved Goosefoot
*Cichorium intybus**	Chicory
Cirsium brevistylum	Indian Thistle
*Cirsium vulgare**	Common Thistle
*Citrullus lanatus**	Watermelon
Clematis ligusticifolia	Virgin's Bower

SCIENTIFIC NAME	COMMON NAME
*Conium maculatum**	Poison Hemlock
*Conyza bonariensis**	S. American Horseweed
*Conyza canadensis**	Common Horseweed
Conyza coulteri	Marsh Horseweed
Cordylanthus rigidus ssp. *rigidus*	Bird's Beak
Corethrogyne filaginifolia var. *virgata*	Virgate Cudweed-aster
*Cortaderia jubata**	Pampas Grass
*Cotoneaster pannosa**	Cotoneaster
*Cotula coronopifolia**	Brass Buttons
Crassula connata var. *erectoides*	Sand Pygmy-stonewort
Crypsis niliaca	Sharp-leaved Crypsis
Cryptantha clevandii var. *florosa*	Cleveland's Large Cryptantha
Cryptantha muricata var. *jonesii*	Jones' Cryptantha
*Cucurbita pepo**	Field Pumpkin
*Cupressus macrocarpa**	Monterey Cypress
Cuscuta ceanothi	Dodder
Cuscuta salina var. *major*	Salt Marsh Dodder
*Cynodon dactylon**	Bermuda Grass
*Cyperus alternifolius**	African Umbrella-sedge
Cyperus eragrostis	Tall Umbrella-sedge
*Cyperus esculentus**	Yellow Nut-grass
Cyperus ferax	Umbrella-sedge
Datura wrightii	Jimson Weed
Descurainia pinnata ssp. *menziesii*	Tansy Mustard
Dicentra chrysantha	Golden Ear-Drops
Displacus longiflorus	Bush Monkey Flower
Distichlis spicata var. *spicata*	Coastal Saltgrass
Dudleya caespitosa	Sand Lettuce
*Echinochloa crusgalli**	Barnyard Grass
*Eclipta alba**	Eclipta
Eleocharis palustris	Pale Spike-rush
Elymus condensatus	Giant Rye
Elymus triticoides	Alkali Rye, Creeping Rye
Encelia californica	California Bush Sunflower
Epilobium canum ssp. *angustifolium*	California Fuchsia
Epilobium ciliatum ssp. *ciliatum*	Northern Willow-herb
Equisetum laevigatum	Smooth Scouring Rush
Equisetum telmateia var. *braunii*	Braun's Giant Horsetail
Eriogonum cinereum	Ashyleaf Buckwheat
Eriogonum fasciculatum ssp. *fasciculatum*	California Buckwheat
Eriogonum parvifolium	Seacliff Buckwheat
Eriophyllum confertiflorum var. *confertiflorum*	Golden Yarrow
*Erodium cicutarium**	Redstem Filaree
*Eucalyptus camaldulensis**	River Red Gum
Eucrypta chrysanthemifolia	Common Eucrypta
*Euphorbia lathyris**	Caper or Gopher Spurge
*Euphorbia peplus**	Petty Spurge
Euthamia occidentalis	Western Goldenrod

SCIENTIFIC NAME	COMMON NAME
*Festuca arundinacea**	Alta or Reed Fescue
Filago californica	California Filago
*Foeniculum vulgare**	Sweet Fennel
Frankenia salina	Alkali Heath
Fraxinus dipetala	Flowering Ash
*Galium aparine**	Common Bedstraw
Glycyrrhiza lepidota var. *glutinosa*	Wild Licorice
Gnaphalium bicolor	Bicolored Cudweed
Gnaphalium californicum	Green Everlasting
*Gnaphalium luteo-album**	Cudweed Everlasting
Gnaphalium microcephalum	White Everlasting
Gnaphalium ramosissimum	Pink Everlasting
Hazardia squarrosa var. *grindelioides*	Sawtooth Goldenbush
Helenium puberulum	Sneezeweed
*Helianthus annuus**	Sunflower
Heliotropium curassavicum var. *oculatum*	Seaside Heliotrope
Hemizonia fasciculata	Fascicled Tarweed
Heteromeles arbutifolia	Toyon
Heterotheca echioides	Bristly Goldenaster
Heterotheca grandiflora	Telegraph Weed
*Hoffmannseggi densiflora**	Indian Rushpea
Holocarpha heermannii	Heermann's Tarweed
Hordeum murinum ssp. *leporinum**	Wild Barley
*Hordeum vulgare**	Cultivated Barley
*Hypochoeris radicata**	Hairy Cat's Ear
Isocoma veneta ssp. *vernoniodes* ssp. *vernonoides*	Coastal Goldenbush
Jaumea carnosa	Fleshy Jaumea
Juglans californica	S. California Black Walnut
Juncus acutus var. *sphaerocarpus*	Spiny Rush
Juncus mexicanus	Mexican Rush
Juncus textilis	Basket Rush
Juncus xiphioides	Iris-leaved Rush
Keckiella cordifolia	Heart-leaved Bush Penstemon
*Kochia scoparia**	Summer-cypress
*Lactuca serriola**	Prickly Lettuce
*Lamarckia aurea**	Goldentop
*Lavatera cretica**	Cretan Lavatera
Lemna gibba	Gibbous Duckweed
Lemna minor	Water Lentil
Lepidium nitidum	Sand Peppergrass
Lepidium lasiocarpum	Pepper-grass
Lepidospartum squamatum	Scale-broom
*Leptochloa uninervia**	Mexican Spangletop

SCIENTIFIC NAME	COMMON NAME
*Linum usitatissimum**	Common Flax
*Lobularia maritima**	Sweet-alyssum
*Lolium multiflorum**	Italian Ryegrass
Lotus salsuginosus	Coastal Hosackia
Lotus scoparius	Deerweed
*Ludwigia uruguayensis**	Water Primrose
Lupinus arboreus	Coastal Bush Lupine
Lupinus succulentus	Succulent Lupine
Lythrum californicum	California Loosestrife
*Madia sativa**	Chilean Tarweed
Malacothamnus fasciculatus var. *nuttallii*	Nuttall's Chaparral Mallow
Malacothrix saxatilis ssp. *tenuifolia*	Coastal Cliff-aster
*Malephora crocea**	Croceum Ice-plant
Malosma laurina	Laurel Sumac
*Malva parviflora**	Cheeseweed
Marah fabaceus var. *agrestis*	Man Root
*Marrubium vulgare**	White Horehound
*Matricaria matricarioides**	Pineapple-weed
*Medicago polymorpha**	Bur-clover
*Medicago sativa**	Alfalfa
*Melilotus alba**	White Sweetclover
*Melilotus indica**	Yellow Sweetclover
Mentzelia sp.	Blazing Star
*Mesembryanthemum crystallinum**	Common Ice-plant
*Mesembryanthemum nodiflorum**	Slender-leaved Ice-plant
*Myoporum laetum**	Myoporum
*Narcissus tazetta**	Polyanthus Narcissus
*Nicotiana glauca**	Tree Tobacco
Oenothera hookeri	Evening Primrose
Opuntia littoralis	Coastal Prickly-pear
*Oryzopsis miliacea**	Smilo Grass, Millet Ricegrass
*Osteospermum fruticosum**	Trailing African Daisy
*Oxalis pes-capris**	Bermuda-buttercup
Panicum capillare var. *occidentale**	Common Witch Grass
*Papaver somniferum**	Opium Poppy
*Parapholis incurva**	Sickle Grass
*Paspalum dilatatum**	Dallis Grass
*Pelargonium X hortorum**	Fish Geranium
*Pennisetum clandenstinum**	Kikuyu Grass
*Pennisetum setaceum**	Fountain Grass
*Pennisetum villosum**	Feathertop
Persicaria amphibia	Swamp Water Smartweed
Persicaria lapathifolium	Willow Smartweed
Persicaria punctata	Dotted Water Smartweed
Phacelia ramosissima var. *austrolitoralis*	Beach Phacelia
Phalaris sp.*	Canary Grass

SCIENTIFIC NAME	COMMON NAME
*Phoenix dactylifera**	Date Palm
Phyllospadix scouleri	Surf Grass
Phyllospadix torreyi	Surf Grass
*Physalis philadelphica**	Tomatillo
*Picris echioides**	Bristly Ox Tongue
Plantago bigelovii ssp. *californica*	Bigelow's Plantain
*Plantago lanceolata**	English Plantain, Ribgrass
*Plantago major**	Common Plantain
Platanus racemosa	California Sycamore
*Poa annua**	Annual Bluegrass
*Polygonum arenastrum**	Common Knotweed
*Polygonum argyrocoleon**	Knotweed
*Polygonum aviculare**	Common Knotweed
*Polypogon monspeliensis**	Rabbitfoot Grass
*Populus alba**	Silver Poplar
Populus trichocarpa	Black Cottonwood
*Portulaca oleracea**	Purslane
Potamogeton foliosus	Leafy Pondweed
Potamogeton pectinatus	Fennel Pondwed
Potentilla anserina	Marsh Cinquefoil
*Raphanis raphanistrum**	Jointed Charlock
*Raphanus sativus**	Wild Radish
Rhus integrifolia	Lemonade Berry
Ribes malvaceum var. *malvaceum*	Chaparral Current
*Ricinus communis**	Castor Bean
*Rorippa nasturtium-aquaticum**	Water-cress
Rosa californica	California Wild Rose
Rubus ursinus	California Blackberry
*Rumex conglomeratus**	Green Dock
*Rumex crispus**	Curly Dock
Rumex maritimus	Golden Dock
Rumex salicifolius	Willow Dock
Ruppia cirrhosa	Spiral Ditch-grass
Salicornia virginica	Pickleweed
Salix laevigata var. *laevigata*	Red Willow
Salix lasiandra var. *lasiandra*	Yellow Willow
Salix lasiolepis var. *lasiolepis*	Arroyo Willow
Salix sessilifolia	Sandbar Willow
*Salsola australis**	Russian Thistle
Salvia leucophylla	Purple Sage
Salvia mellifera	Black Sage
Sambucus mexicana	Blue Elderberry
*Schismus barbatus**	Arabian Grass
Scirpus acutus	Common Tule
Scirpus californicus	California Bulrush
Scirpus cernuus ssp. *californicus*	Low Club-rush
Scirpus maritimus	Prairie or Alkali Bulrush
Scirpus pungens	Three Square
Scrophularia californica var. *floribunda*	California Figwort
*Senecio mikanioides**	German-ivy

SCIENTIFIC NAME	COMMON NAME
*Senecio vulgaris**	Common Groundsel
*Silene gallica**	Windmill Pink
*Silybum marianum**	Milk Thistle
*Solanum americanum**	Small-flowered Nightshade
Solanum douglasii	Douglas Nightshade
*Solanum rantonnetii**	Blue Potato Bush
*Solanum rostratum**	Buffalo-bur
*Solanum sarrachoides**	Hairy Nightshade
Solanum xantii var. *xantii*	Purple Nightshade
Solidago confinis	Marsh Goldenrod
*Sonchus asper**	Prickly Sow-thistle
*Sonchus oleraceus**	Sow-thistle
*Sorghum bicolor**	Sorghum, Broom Corn
*Spartium junceum**	Spanish Broom
*Spergula arvensis**	Corn Spurrey
*Spergularia bocconii**	Boccon's Sand Spurrey
Spergularia macrotheca	Large-flowered Sand Spurrey
Spergularia marina	Marsh Spurrey
Stachys bullata	California Hedge Nettle
*Stellaria media**	Common Chickweed
Suaeda taxifolia	Wooly Sea-blite
*Tagetes patula**	Marigold
*Tamarix ramosissima**	Tamarisk, Salt Cedar
*Tetragonia tetragonioides**	New Zealand Spinach
Toxicodendron diversilobum	Poison Oak
*Tropaeolum majus**	Garden Nasturtium
Typha angustifolia	Narrowleaf Cattail
Typha domingensis	Narrowleaf Cattail
Typha latifolia	Broadleaf Cattail
Urtica dioica ssp. *gracilis* var. *holosericea*	Giant Creek Nettle
*Urtica urens**	Dwarf Nettle
Venegasia carpesioides	Canyon Sunflower
Verbena lasiostachys	Hairy-spike Verbena
*Veronica anagallis-aquatica**	Water Speedwell
*Vicia benghalensis**	Purple Vetch
Vulpia myuros var. *hirsuta*	Foxtail Fescue
*Xanthium spinosum**	Spiny Cocklebur
Xanthium strumarium var. *canadense*	Cocklebur
Zannichellia palustris	Horned Pondweed
*Zantedeschia aethiopica**	Calla Lily
*Zea mays**	Cultivated Corn

B: ADDITIONAL SPECIES RECORDED IN THE H.M. POLLARD CARD FILE AT SBBG. CS = the Ventura River upstream from the study area to Foster Park and Casitas Springs; TR = vicinity of Taylor Ranch[1] ; FG = County Fairgrounds; PB = eastern Pierpont Bay; ? = "near" the Ventura River Mouth.

SCIENTIFIC NAME	COMMON NAME
Acacia dealbata Link. [CS]	Silver Wattle
Acacia longifolia Willd.* [TR]	Golden Wattle
Achillea millifolium L. ssp. *californica* (Poll.) Jeps. [TR]	White Yarrow
Amaranthus hybridus L.* [CS]	Hybrid Amaranth
Amaranthus palmeri Wats.* [TR]	Palmer's Amaranth
Amaranthus retroflexus L.* [TR,CS]	Pigweed
Ambrosia acanthicarpa Hook. [CS]	Annual Burweed
Amsinckia tessellata Gray [CS]	
Aphanisma blitoides Nutt. ex Moq. in DC. [TR]	Aphanisma
Apiastrum angustifolium Nutt. in T. & G. [TR]	Wild Celery
Apocynum cannabinum L. var. *glaberrinum* DC. [CS]	Indian Hemp
Araujia sericofera Brot.* [CS]	Bladder Flower
Arthrocnemum subterminale (Parish) Standl. [TR]	Parish's Glasswort
Asclepias fascicularis Dcne. in DC. [TR]	Narrowleaf Milkweed
Aster chilensis Nees. [CS]	Chilean Aster
Atriplex argentea Nutt. ssp. *expansa* (Wats.) Hall & Clem. [PB]	Silver Saltbush
Bidens laevis (L.) BSP. [CS]	Bur Marigold
Borego officinalis L.* [TR]	Borage
Brassica hirta Moench.* [?]	White Mustard
Bromus madritensis L.* [TR]	Madrid Brome
Calandrinia maritima Nutt. [TR]	Seaside Calandrinia
Carex pansa Bailey [PB]	Dune Sedge
Carex senta Boott [CS]	Rough Sedge
Centranthus ruber (L.) DC.* [?]	Red Valerian
Chaenactis glabriuscula DC. var. *denudata* (Nutt.) Munz [PB]	Pincushion
Chenopodium album L.* [CS]	Lamb's Quarters
Chenopodium botrys L.* [CS]	Jerusalem Oak
Chenopodium multifidum L.* [FG]	Cutleaf Goosefoot
Chrysanthemum coronarium L.* [PB]	Garland Chrysanthemum
*Chrysanthemum parthenium** [FG]	Feverfew
Cirsium occidentale (Nutt.) Jeps. [TR]	Western Thistle
Cnicus benedictus L.* [CS]	Blessed Thistle
Convolvulus arvensis L. [?]	Bindweed

[1]Most citations from TR refer to collections from coastal bluff habitats west of the study area.

*naturalized or planted species

SCIENTIFIC NAME	COMMON NAME
Corethryogyne filaginifolia (H. & A.) Nutt. var. *latifolia* Hall. [PB]	Cudweed-aster
Coronopus didymus (L.) Smith* [?]	Wart Cress
Cressa truxillensis HBK. var. *vallicola* (Heller) Munz [FG]	Alkali Weed
Croton californicus Muell.-Arg. [PB]	California Croton
Cryptantha intermedia (Gray) Greene var. *intermedia* [TR]	Common Cryptantha
Dactylis glomerata L. [CS]	Orchard Grass
Daucus pusillus Michx. [TR]	Yerba Del Vibora
Digitaria sanguinalis (L.) Scop.* [CS]	Hairy Crab Grass
Dudleya lanceolata (Nutt.) Britt & Rose [TR]	Rock Lettuce
Eleocharis parishii Britt. [CS]	Parish's Spike-rush
Eragrostis barrelieri Daveau* [CS]	
Eragrostis cilianensis (All.) E. Mosher* [CS]	Stink Grass
Eragrostis diffusa Buckl. [CS]	Love Grass
Eragrostis orcuttiana Vasey [CS]	Orcutt's Eragrostis
Eremocarpus setigermis (Hook.) Benth. [CS]	Dove Weed
Ericameria ericoides [PB]	Mock Aster
Erigeron foliosus Nutt. var. *stenophyllus* (Nutt.) Gray [TR]	Leafy Daisy
Eucalyptus globulus Labill.* [FG]	Blue Gum
Galium nuttallii Gray ssp. *nuttallii* [TR]	Nuttall's Bedstraw
Gilia capitata Sims ssp. *abrotanifolia* (Nutt. ex Greene) V. Grant [TR]	Blue Field Gilia
Grindelia robusta Nutt. [TR?]	Robust Gum-plant
Ipomea purpurea (L.) Roth.* [?]	Common Morning-glory
Iva axillaris Pursh ssp. *robustior* (Hook.) Bassett [CS]	Poverty Weed
Juncus patens E. Mey. [CS]	Common Rush
Lathyrus latifolius L.* [?]	Everlasting Pea
Lavatera assurgentiflora Kell.* [?]	Malva Rosa
Lemna minima Phil. [CS]	Duckweed
Lemna perpusilla Torr. [CS]	Duckweed
Lemna valdiviana Phil. [CS]	Duckweed
Lippia nodiflora (L.) Michx. var. *rosea* (D. Don) Munz* [CS]	Garden Lippia
Lotus corniculatus L.* [TR]	Birdsfoot Trefoil
Lotus strigosus (Nutt. in T. & G.) Greene [CS]	Bishop's Lotus
Lotus tenuis Waldst. & Kit. ex Willd. [CS]	
Lupinus excubitus Jones [CS]	Interior Bush Lupine
Lupinus longifolius (Wats.) Abrams [CS]	Watson's Bush Lupine
Lycopersicon esculentum Mill.* [CS]	Tomato
Malva nicaeensis All.* [CS]	Bull Mallow
Melica imperfecta Trin. [TR]	Coast Range Melic

SCIENTIFIC NAME	COMMON NAME
Mentha arvensis L. [CS]	Mint
Mentha piperita L.* [CS]	Peppermint
Mentha spicata L.* [CS]	Spearmint
Mentzelia laevicaulis (Doug. ex Hook.) T. & G. [CS]	Blazing Star
Microseris linearifolia (Nutt.) Chambers [TR]	Uropappus
Mimulus cardinalis Doug. ex Benth. [CS]	Scarlet Monkey Flower
Mimulus guttatus Fisch. ex DC. [CS]	Monkey Flower
Muhlenbergia microsperma (DC.) Kunth [TR]	Annual Muhlenbergia
Oligomeris linifolia (Vahl) Macbr. [TR]	Narrowleaf Oligomeris
Opuntia oricola R. Philbrick [TR]	Tall Prickly-pear
Opuntia prolifera Engelm. [TR]	Coastal Cholla
Orthocarpus densiflorus Benth. [TR]	Owl's Clover
Orthocarpus purpurascens Benth. [TR]	Common Owl's Clover
Panicum miliaceum L.* [CS]	Broom-corn Millett
Parietaria hespera Hinton var. *californica* Hinton [TR]	California Pellitory
Parthenocissus quinquefolia (L.) Planch.* [FG]	Virginia Creeper
Paspalum distichum L. [CS]	Knotgrass
Petunia parviflora Juss. [PB]	Wild Petunia
Petunia violacea Lindl.* [CS]	Violet-flowered Petunia
Phacelia distans Benth. [TR]	Wild Heliotrope
Phalaris canariensis L.* [TR]	Canary Grass
Phalaris minor Retz* [?]	Mediterranean Canary Grass
Phleum pratense L.* [TR]	Timothy
Phoradendron tomentosum (DC.) Engelm. ex Gray ssp. *macrophyllum* (Engelm.) Weins [CS]	Bigleaf Mistletoe
Pluchea purpurascens (Sn.) DC. [PB,CS]	Marsh Fleabane
Polypogon interruptus HBK.* [CS]	
Prosopis glandulosa Torr. var. *torreyana* (L. Benson) (M. C. Jtn.)* [TR]	Honey Mesquite
Prunus persica Batsch.* [?]	Peach
Psoralea macrostachya DC. [CS]	Leather Root
Pterostegia drymarioides F. & M. [TR]	Fairy Mist
Rafinesquia californica Nutt. [TR]	Rafinesquia
Reseda alba L.* [?]	White Mignonette
Romneya trichocalyx Eastw. [CS]	Matilija Poppy
Ruppia maritima L. [PB]	Ditchgrass
Sanguisorba minor Scap.* [TR]	Burnet
Scabiosa atropurpurea L.* [?]	Mourning Bride
Scirpus americanus Pers. (=*S. olneyi* Gray) [CS]	Three Square
Senecio douglasii DC. [PB]	Bush Groundsel
Silene antirrhina L. [TR]	Sleepy Catchfly
Sisymbrium irio L.* [?]	London Rocket
Sisymbrium orientale L.* [TR]	Oriental Sisymbrium
Sisyrinchium bellum Wats. [?]	Blue-eyed Grass
Solanum elaeagnifolium Cav.* [CS]	White Horse Nettle
Sorghum halepense (L.) Pers.* [TR]	Johnson Grass

SCIENTIFIC NAME	COMMON NAME
Stachys albens Gray [CS]	White Hedge Nettle
Stephanomeria virgata Benth. ssp. *virgata* [CS]	Virgate Stephanomeria
Stipa lepida Hitchc. [TR]	Small-flowered Needlegrass
Suaeda calceoliformis L. [FG]	Annual Seepweed
*Tamarix aphylla** [PB]	Tamarisk
Trifolium fucatum Lindl. var. *gambelli* (Nutt.) Jeps. [CS]	Ball Clover
Trifolium obtusifolium Hook. [CS]	Creek Clover
Triglochin striatum Ruiz & Pavon [PB]	Ribbon Arrowgrass
Triticum aestivum L.* [TR]	Cultivated Wheat
Verbesina encelioides (Cav.) Benth. & Hook. var. *exauriculata* Rob. & Greenm.* [CS]	Crownbeard
Veronica americana (Raf.) Schw. [CS]	Brook Lime
Vicia dasycarpa Ten.* [CS]	Smooth Vetch
Zantedschia aethiopica (L.) Spreng.* [CS]	Calla Lily
Zostera marina L. var. *latifolia* Morong [PB]	Eel-grass

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